RAILROAD GAZETTE

FRIDAY, SEPTEMBER 7.

CONTENTS.

Contributions.

Southern Railroads.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In compliance with your request I herewith give you my opinion of the condition of the railroads in the Southern states.

I will allude freely to the Louisville & Nashville Railroad, as it is the most extensive system in the Southern states, extending from the extreme south at New Orleans and Pensacola up to Cincinnati and St. Louis on the north, thus traversing all the middle tier of Southern states. Moreover, I am very familiar with this entire system, having recently thoroughly examined it for some English and German owners of its stock and bonds.

Nearly all the railroads in the South were built for local traffic, principally to transport to market agricultural products, but since the through traffic has so largely increased and from the wonderful development of the iron and coal interest in Alabama and Tennessee, the old agricultural or farm railroads have been found incapable to transport the heavy traffic economically. For several years past, the managers have been devoting all their spare money to putting their roads in better condition, in order to handle their heavy business more advantageously. Iron rails have been changed for heavier steel rails; bridges built to carry light loads have been strengthened or changed for those capable of carrying the 60-ton consolidation engine, and cars carrying a load of 30 tons. This change has been made on over 1100 miles of the Louisville & Nashville system and is still going on as fast as their means will permit. All the rolling stock recently bought by this company is of the heaviest description—consolidation engines weighing 60 tons and freight cars to carry 30 tons of freight.

This change has already produced great reduction in operating expenses, as is shown in the following table of the total cost of transporting one ton one mile on the main stem of the Louisville & Nashville:

Year 1883, total cost in cents	.629
Year 1884, total cost in cents	.657
Year 1885, total cost in cents	.607
Year 1886, total cost in cents	.571
Year 1887, total cost in cents	.499

Many of the other Southern railroads have been obliged recently by the great increase in their traffic to add largely to their rolling stock. These additions have generally been of the heavy type. On some of these roads can be seen trains of greater weight for a given length than on the Northern roads, showing that the physical condition of the roads must be good.

Most of the Southern railroads show great improvement in the past few years in policing—the line being kept much neater than formerly. The last annual inspection of the Louisville & Nashville system was made during February, at the end of a severe winter. Notwithstanding this unfavorable time, the average for policing on the entire system was 8.06—10 being the maximum or perfection. On some divisions the average was 8.97, 9.11, 9.14, 8.93—very high, considering the time the inspection was made.

On my recent trips South, I also noticed a great improvement in the general condition of the track and the alignment. The heavy rolling stock had obliged the managers of the roads to pay much more attention to ballast—there have recently been very large additions of broken stone ballast on many of the lines—but for economical reasons it has generally been put down too thin; most of it will have to be made thicker to keep the heavy loads from working it into the ground.

The southern roads are generally deficient in station and yard facilities, the business having outgrown what was originally thought sufficient. To bring them up to the necessary standard and size will require large outlay. The managers have wisely devoted their spare means to improving the roadbed, bridges, and rolling stock and track, leaving the stations and yards as less urgent—to be improved when money becomes more plentiful.

No section of the United States can show greater comparative improvement within the last three years in their railroads than the Southern states.

EDWARD BATES DORSEY, M. Am. Soc. C. E.

The Bull-head and Flange Rail Systems of Permanent Way.

RONDESHBOSCH, SOUTH AFRICA.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I observe that the relative merits of the flange and bull-head rail, or the English and the American systems of permanent way, are sometimes discussed on your side of the water. I gather that it is claimed that the bull-head rail and chair is preferred in Great Britain, because (1) it is better suited to rigid rolling stock, popularly supposed to be in universal use there, but that (2) were flexible rolling stock adopted, the flange rail would answer the same purpose at a far smaller cost. I venture to deny the correctness of both these assertions, and think that a little examination will show that they are considerably wide of the mark. In actual practice the flange rail system is not more rigid laterally than the other. Though the bull-head rail itself is more flexible laterally than the flange rail, the fastenings are more rigid: (1), they have a greater leverage, being some 12 in. instead of about 5 in. apart; (2), the fastenings on both sides of the rail are efficient to prevent it spreading; and (3), the fastenings last longer, the bearing surface of the thick base of the chair being greater than that given by the thinnest portion of the thin flange, which soon cuts off the heads of the spikes.

Another factor also contributes to make the bull-head and chair permanent way more rigid laterally than the flange rail track, both being in average rather than first rate condition. The flange rail, owing to its smaller bearing surface, cuts deeply into the ties, while the chairs have a bearing surface equivalent to a flange rail with a base about one foot wide. The chair track is consequently tolerably firm, while the flange rail has cut into the ties, and the consequent vertical motion has cut and pulled out the fastenings, permitting a large amount of lateral play.

Twenty years ago constant complaint was made of the costly and inefficient construction of permanent way. These complaints have entirely ceased so far as England is concerned. Numerous systems of permanent way have been tried, but the uniform nature of the present practice there shows the survival of the fittest. The English system involves great weight and first cost, but it gives undeniable good results, and the best of anything is generally expensive. The general tendency all over the world seems to be towards heavier rails, thus approximating towards English practice in this respect. Heavy rails have certainly been worth their extra cost on the heavy grades and sharp curves of this colony, though all our stock, like yours, has a flexible wheel base.

The really weak point about the bull-head and chair track is the wood key, which is loosened by sudden changes in the amount of moisture present in the atmosphere. This difficulty has been overcome in the perennially damp English climate, but is formidable in countries where the air is at times extremely dry.

The flange rail has undoubted advantages in being simpler and more easily laid, and is therefore always employed for temporary work. If the cheapest track is required, the flange rail system should be chosen, but the smoothest and most durable track is at present the more costly chair system. Personally, I believe that within the next few years both will be largely superseded by a metallic permanent way, on the general principles of that of Mr. F. W. Webb, of the London & Northwestern. The inevitable tendency is to supersede wooden ties by steel, and spikes and bolts by rivets closed by hydraulic pressure. A permanent way in which the ties last for 50 years and the fastenings never shake loose has immense advantages. ROUW KOOP.

Rail Tests and Weight of Rails.

PITTSBURGH, Sept. 4, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The question of a satisfactory method of testing steel rails so as to determine what constitutes the best wearing rail—rail that will give the longest service in track—is one that still remains unsettled, even at this advanced stage of rail manufacture and railroad building, notwithstanding much that has been written and said, and the time spent by both railroad and steel experts upon the subject.

So far as chemical tests are concerned, it has been found that it does not do to rely solely upon such analyses in order to determine this question, as rails that have conformed to all the chemical requirements have broken down and rendered bad service in a short time after going into track. So, evidently, chemical analyses alone will not determine this question. I trust I may not be misunderstood in what I have stated, nor understood to imply thereby that chemistry is to be ignored in this matter.

But, if chemical tests be not sufficient, what then? This brings us to the matter of physical tests, which are in a great many cases, I regret to state, sadly neglected. During all my experience as an inspector and my visits to the different rail mills throughout the country I have found, with but a few exceptions, that but little, if any, attention is paid to these tests. This may be due in part to the railroad companies, who, with but a very few exceptions, do not require these tests to be made. Of all the railroads for whom I have so far inspected, *but one road* has required physical tests to be made of its rail steel. I have often had such tests made for my own satisfaction when doubtful as to the good quality of metal. At some mills I have found the machine for making drop tests not only idle, but in such a dilapidated condition that it was utterly unfit for use, and fit for but the scrap pile. Had I requested tests to be made at such a mill nothing but a new machine would have answered my purpose. Every rail mill should have, and keep in good order, ready for use, an apparatus for drop tests.

The following physical tests, which are in use at a few of the largest mills in the country, I would advocate to every purchaser of rails, to be included in the specifications furnished to the mill.

From each blow, or charge, of the converter, after being blown, and while being poured from ladle into ingot molds, a small test ingot to be cast, size either 4 in. × 4 in. × 6 in. or 6 in. × 6 in. × 8 in. This ingot then to be taken to the forge and from it a bar drawn out ¾ in. or 1 in. square, and about 10 in. long. Such a bar when cold to bend to an angle of 90 degrees without fracture. If sign of fracture appear, then two other bars of same size to be drawn out and tested in like manner. Should two bars fail to stand the test, then the blow from which the ingot was taken to be rejected—rails from such heat *not* to be classed as *first* quality.

Should, however, two bars stand the test, then, after the blow has been rolled into rails, a drop test to be made of the rail section and the same rule followed out in this as in the bar test. If two pieces fail, reject the heat, if they stand the test accept the rails.

The inspector for the railroad company should make and preserve note of all tests of his rail steel, and special note of heats that fail to stand the tests. A complete chemical analysis should also be made of every heat rejected, as the cause of the failure of the steel to stand the tests may be discovered thereby.

Although chemical analyses and physical tests greatly aid in determining the quality of the steel, and give the inspector an idea of how it is running from converter to rail mill, a halt should not be made here, but further research carried on; and here it is that the railroad companies can lend valuable assistance in throwing more light upon this all important subject.

Mr. F. A. Delano, of the Chicago, Burlington & Quincy, who has treated this subject so ably in your issue of Aug. 10 recommends the marking of one rail—for a test rail—out of every 1,000 tons. To this point in Mr. Delano's article I would take exception, as I consider it far from being an accurate test and one that would throw but little light on the matter. With the exception of some of the smaller mills, this would mean taking one rail from about every 100 heats, allowing 10 tons to the blow, and not taking into consideration the loss in blowing, heating and rolling the steel, which would but add to the number of heats in every 1,000 tons.

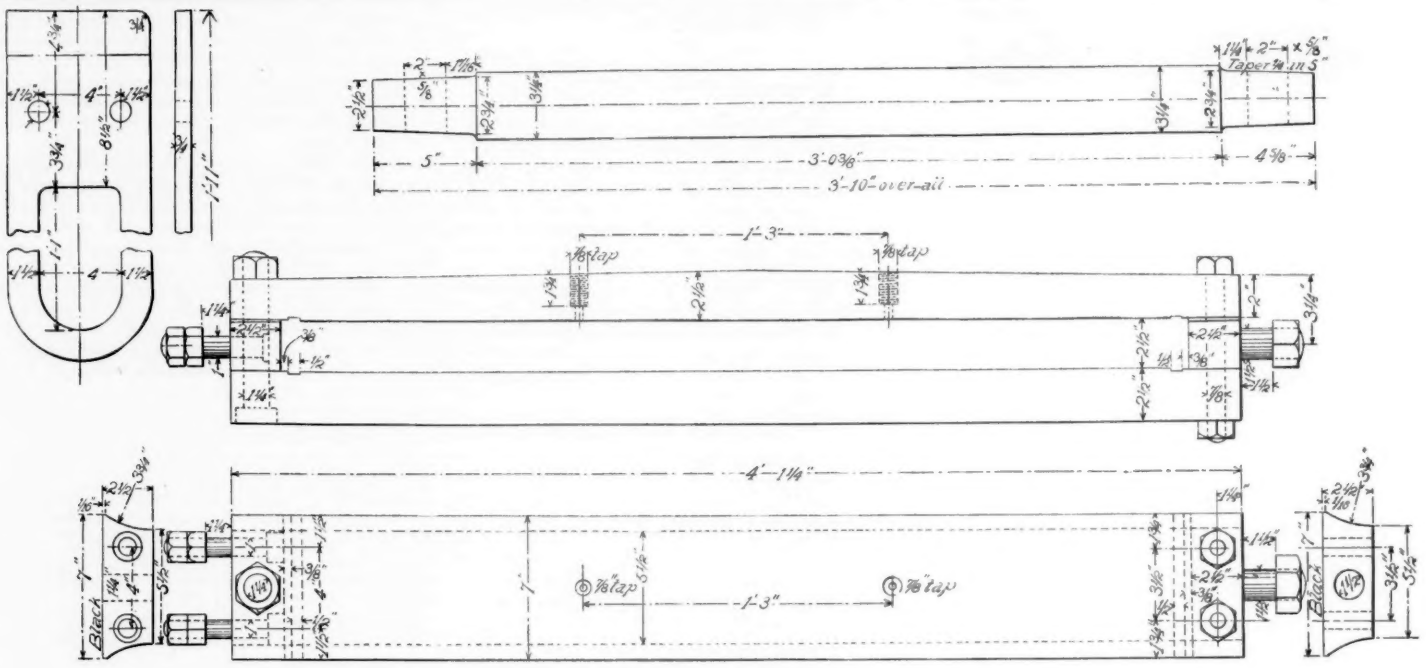
I would recommend the marking of one rail from *each* heat in such a manner that rails marked could readily be distinguished from the remainder, and picked out by the railroad company upon arrival of lot at their yards. In addition to painting these rails with some bright colored paint either on ends, sides of web or upper sides of flange, I would suggest the stamping of each one with a special stamp or die on sides of web, or upper sides of flange with any mark not to conflict with those of the manufacturer. Such marks on test rails should be clearly and deeply stamped so as to be easily distinguished; and what is more important, to withstand the ravages of time and the elements on the metal. Upon arrival at the yards or tracks of the railroad company these test rails should be picked out and set apart by themselves, and upon being put into service should be laid all together in one piece of track, and under like conditions of wear.

These rails should be closely watched, and a record kept of the kind of service they give. From time to time a report to be made upon their condition at the time, and such report sent to headquarters. At any time that the railroad company might so desire, a sample of the steel from any one or more heats could be obtained from the mill company, provided that the steel company called upon pay any attention to the matter of tests, and retain samples of steel from each blow for future reference.

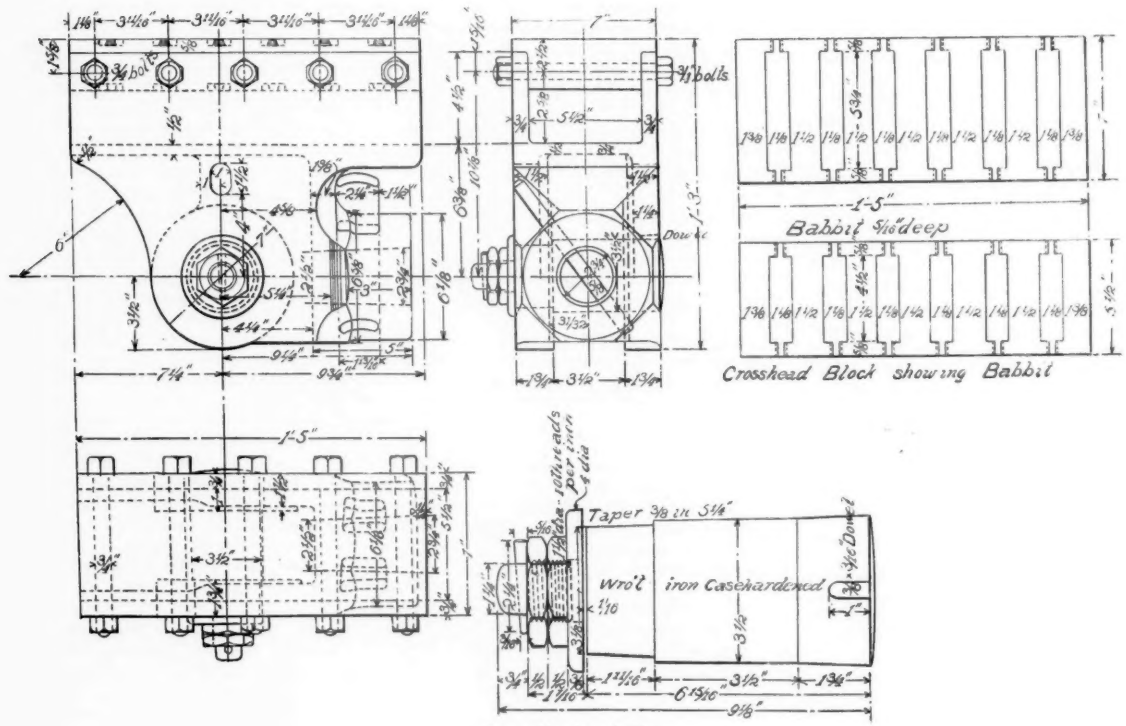
To mark and pick out test rails from each heat, as I have suggested, and after they have been picked out, to watch and keep record of their service in track would, I know, require particular care and attention on the part of both mill and railroad company—too much perhaps for any such system of tests to be generally adopted; but without such care and attention we cannot hope to arrive at the solution of the question as to what rail will give the best service in track.

To digress from the subject at hand I would beg to state that I feel assured that a great many railroads in this country are not using a rail heavy enough to be commensurate with the increased weight of rolling stock. I have inspected rails weighing but 51 and 56 lbs. per yard for railroads that at the time were, and at present are, running locomotives weighing from 50 to 60 tons, and freight cars of 50,000, 60,000 and 65,000 lbs. capacity. These rails went into the main tracks where traffic was both heavy and quick. Can such light rails, even if of the very best material, stand such wear? Some of the roads have taken this matter up and adopted heavier sections. Witness the Pennsylvania 85-lb., the New York Central 80-lb., and the Reading 90-lb., and I trust that ere long every road will realize the importance of this matter and adopt heavier rails. Much has been said on this subject before, *pro et con*, but I hope the discussion will continue until heavier rails predominate. Mr. C. P. Sandberg, of London, has treated this subject most ably in your columns upon several occasions.

In conclusion, I would state that the tests here suggested I recommend, not as a solution of the question of what makes the best rail, but as an aid in further enlightening the matter. As yet no tests are known that will justify guaranteeing the life of any rail; they are but steps leading to what I trust may some day prove the discovery of this question.



Slide Bars and Piston Rod.



Cross Head and Pin.

DETAILS OF WOOTTEN EXPRESS LOCOMOTIVE, UNION PACIFIC RAILWAY.

Until then let both the rail mills and railroads lend their untiring efforts to this discovery.

FRANK WARD.

[The specifications for rails and fastenings, lately adopted by Frank Ward & Brother, are given in another column.—EDITOR]

Wootten Express Locomotive, Union Pacific Railway.

The accompanying illustrations represent details of an American type Wootten express locomotive built by the Rogers Locomotive Works for the Union Pacific Railway. This engine was designed by Mr. Clem Hackney, Superintendent Motive Power, and detail views of the boiler and fire-box and a perspective view of the engine and tender will be found in our issue of June 15, 1888. The boiler, fire-box and extension front were illustrated in the same issue, and the driving wheels and axles, crank pins, and connecting and coupling rods, were shown on page 436, July 6, 1888. The frame was illustrated on page 534, Aug. 17, 1888.

The engravings are carefully reproduced from working drawings and show the construction of the various parts very clearly. The cross-head is of the Laird type and is made of cast steel, planed, slotted and bored. The cross-head rubbing pieces are of cast-iron, cast in dry sand with babbitted cross pieces. No oil ways are cut on the rubbing pieces.

The slide bars are made of tough, strong and moderately hard cast iron, cast in dry sand.

The piston rod is shouldered down ⅛ in diameter where it enters the cross-head and piston, so as to allow for wear. The piston rod is made of Otis open-hearth steel, as per specification No. 242, given below. The piston rod key is made of Otis hammered steel.

Union Pacific Railway Co.—Motive Power and Car Department.

SPECIFICATION NO. 242.

FOR LOCOMOTIVE MAIN, PARALLEL AND PISTON RODS.

All rods to be of best quality open-hearth American steel, and must be carefully forged to sizes given in the requisition.

They will be ordered subject to the following conditions:

For each lot of 10 rods ordered 1 piece, not less than 8 in. long, cut at random from end of some rod in lot supplied, to be sent for test, and to represent quality of the lot supplied.

A test piece cut from any part of a rod ¼ in. to ½ in. under the surface to have a tensile strength of 75,000 lbs. per sq. in., and an elongation of 25 per cent. or over in test section originally 4 in. long and 1 in. dia. Steel having more than 80,000 lbs., or less than 70,000 lbs. tensile strength per sq. in., or having an elongation of less than 20 per cent. in above test section will not be accepted.

Should rods develop mechanical defects in finishing they will be rejected.

OMAHA, March 19, 1888.

The piston rings are of cast iron, turned all over. The rings are turned off to 18¼ in. dia. for an 18-in. cylinder, then a piece is cut out of ring and they are sprung in groove made for their reception in piston. The nuts for the follower bolts are of brass.

The driving-boxes are of cast iron. The driving-box brasses are made of 88.88 per cent. copper and 11.11 per cent. tin (8 to 1), and are forced into the driving-boxes by a pressure of 10 tons, and have a 1-in. brass plug driven through from the top of the driving-box into the brass to assist in keeping the latter in position.

The axle is fitted at first to bear all over the brass and then enough is taken out of the crown so as to make it a close fit on the sides.

The lubricator used in the driving-box cellars is woollen waste and oil. No metallic spring is used to cause the waste to bear against the axle, as the elasticity of the waste itself is found to be sufficient to insure contact.

Notes on Fuel and Combustion.

BY RICHARD H. BUEL, C. E.

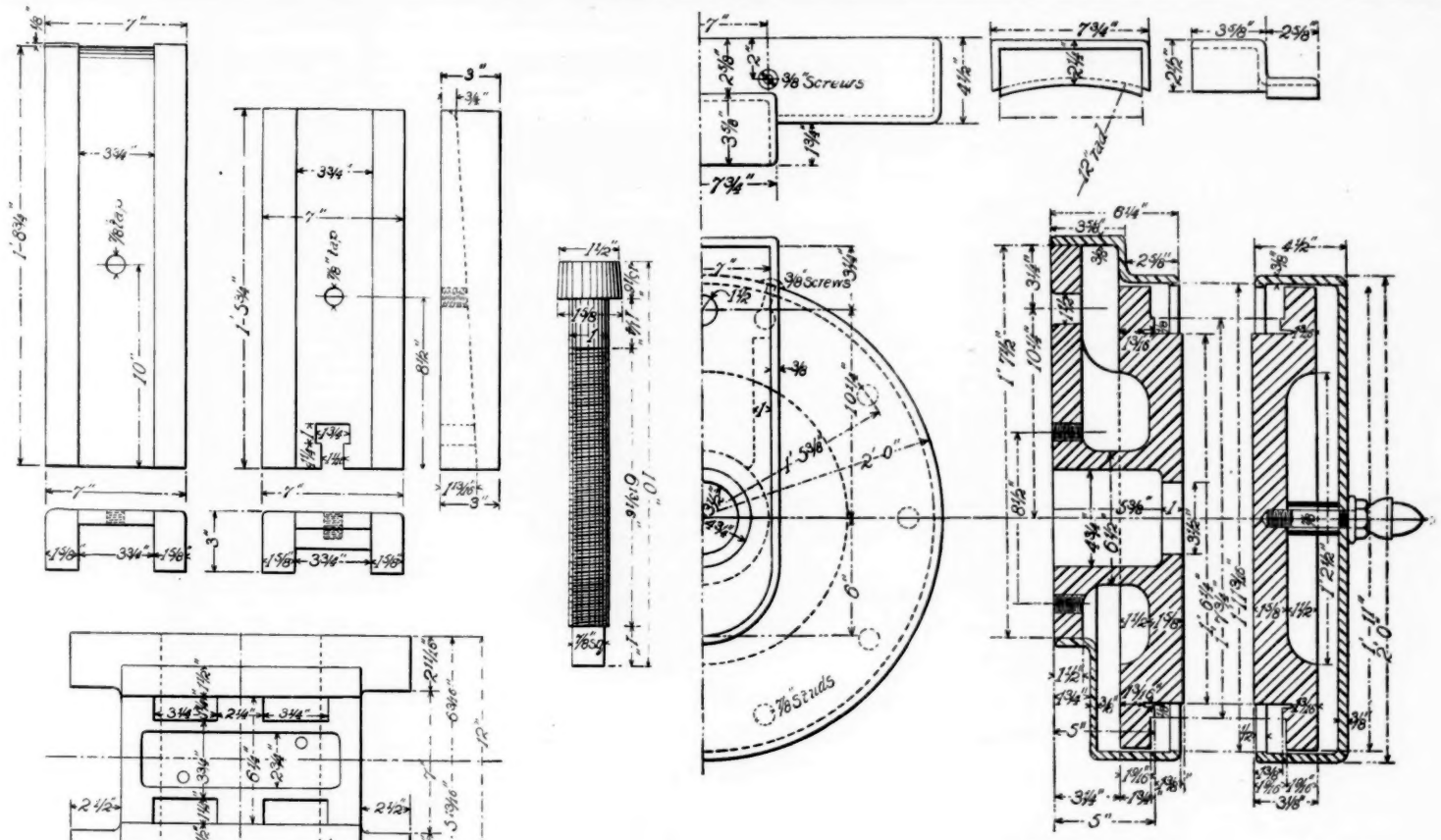
IV.

SOLID MINERAL FUEL.

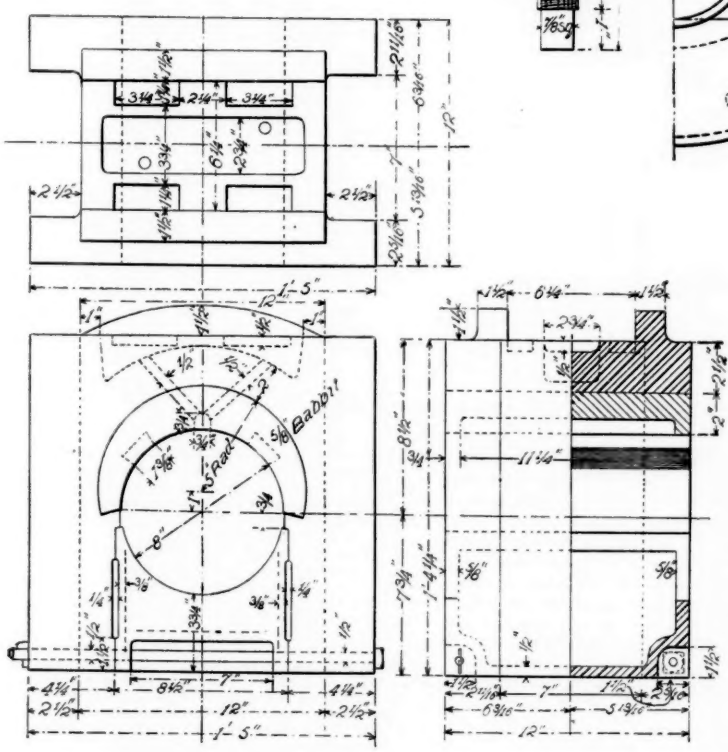
Mineral fuel in the solid form, commonly called *coal*, is defined by Mr. John Percy as follows:

"Coal is a solid, stratified mineral combustible substance, varying in color from dark brown to black, opaque, except in extremely thin slices, brittle, not fusible without decomposition, not sensibly soluble in ether, benzole, chloroform or oil of turpentine, not containing sufficient earthy matter to render it incapable of being applied with advantage as a source of heat either in ordinary fireplaces or in furnaces."

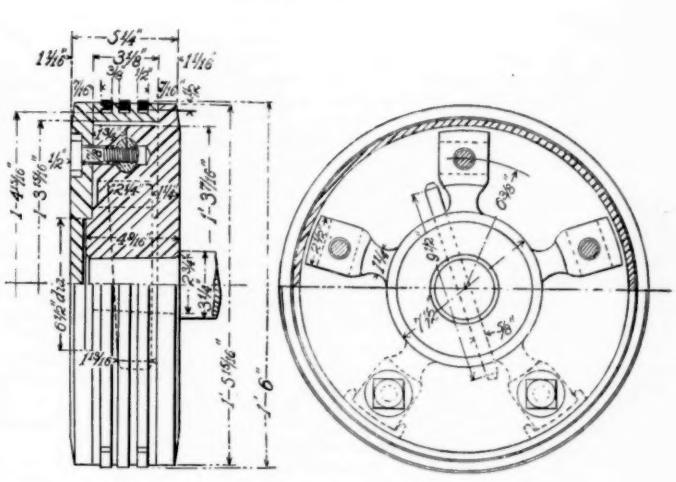
The line between mineral and vegetable fuel is not well defined, and there are numerous varieties of fuel, called *lignites*, about which there is much dispute among geologists as to whether they are entitled to the name of coal or not. The fuels which are ordinarily regarded as coal are divided into two general classes, *anthracite* and *bituminous* coal, but there are numerous sub-divisions, the classification of coals, as made by different authorities, varying considerably. A very common mode of arrangement is to class the different varieties of fuel according to their relative states of carbonization, commencing with wood, which contains the least percentage of carbon, and



Cylinder Covers.



Driving Axle Box, Wedges and Lifting Screw.



Piston.

DETAILS OF WOOTTEN EXPRESS LOCOMOTIVE, UNION PACIFIC RAILWAY.

ending with anthracite coal, which represents the most complete carbonization of mineral fuel existing in a natural state. Different specimens of fuel in the same class vary considerably in their composition, and the following table which represents a popular classification of solid fuel, and shows the gradual change of composition as the carbonization becomes more complete, gives average values of the composition of each class, calculated from a large number of individual analyses.

Classification of Solid Fuel.

Class.	Composition of dry fuel. Parts by weight in 100.					
	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Sulphur.	Ash.
Wood	49.8	6.0	41.2	1.1	...	1.8
Peat	59.9	6.1	30.3	1.3	...	2.4
Lignite	71.0	4.9	16.3	1.2	1.2	5.4
Mineral charcoal	73.6	2.7	5.8	1.5	....	16.4
Bituminous coal. Non-caking	79.8	4.6	10.5	1.3	0.4	3.4
Bituminous coal. Caking	81.7	5.1	8.6	0.7	0.6	3.3
Bituminous coal. Welsh	86.9	4.4	3.1	1.3	0.9	3.4
Anthracite coal.	89.3	2.5	1.7	0.7	....	5.8

Nearly all the varieties of solid fuel mentioned in the preceding table are found in the United States. West of the Alleghany Mountains much of the fuel is semi-coal or lignite, frequently containing so much sulphur as to be unsuitable for use in the furnaces of boilers. Either coal or lignite is found in nearly every part of the United States, and according to official reports mines are worked in 29 states and territories. More than half the annual coal production is derived from the state of Pennsylvania, as shown in the following table, which is compiled from data published by the United States Geological Survey. The quantities given in this table are exclusive of the amounts used at the different collieries.

Coal Production in the United States for 1887.

States and Territories.	Quantity. Gross tons.	Value at mines. Dollars. Total.	Per gross ton.
Alabama	1,696,429	2,470,000	1.46
Arkansas	133,929	252,500	1.89
California	44,643	150,000	3.36
Colorado	599,763	3,941,817	2.46
Dakota	19,170	32,205	1.68
Georgia	280,103	470,573	1.68
Idaho	446	2,000	4.48
Illinois	9,177,580	11,152,596	1.22
Indiana	2,872,956	4,324,604	1.51
Indian Territory	612,420	1,286,692	2.10
Iowa	3,994,489	5,991,735	1.50
Kansas	1,425,785	2,235,631	1.57
Kentucky	1,726,058	2,223,163	1.29
Maryland	2,926,806	3,114,122	1.06
Michigan	62,805	107,191	1.68
Missouri	2,865,996	4,298,994	1.50
Montana	9,109	35,707	3.92
Nebraska	1,339	3,000	2.24
New Mexico	453,602	1,524,102	3.36
Ohio	9,197,954	9,096,848	0.99
Oregon	28,300	70,000	2.47
Pennsylvania Anthracite	35,273,442	79,365,244	2.25
Pennsylvania Bituminous	27,559,466	27,806,941	1.01
Rhode Island	5,357	16,250	3.03
Tennessee	1,696,429	2,470,000	1.46
Texas	66,964	150,000	2.24
Utah	160,733	360,042	2.24
Virginia	736,842	773,360	1.05
Washington Territory	689 832	1,699.746	2.46
West Virginia	4,318 589	4,594,979	1.06
Wyoming	1,044,927	3,510,954	3.36
Totals and average	110,683,263	173,530,996	1.57

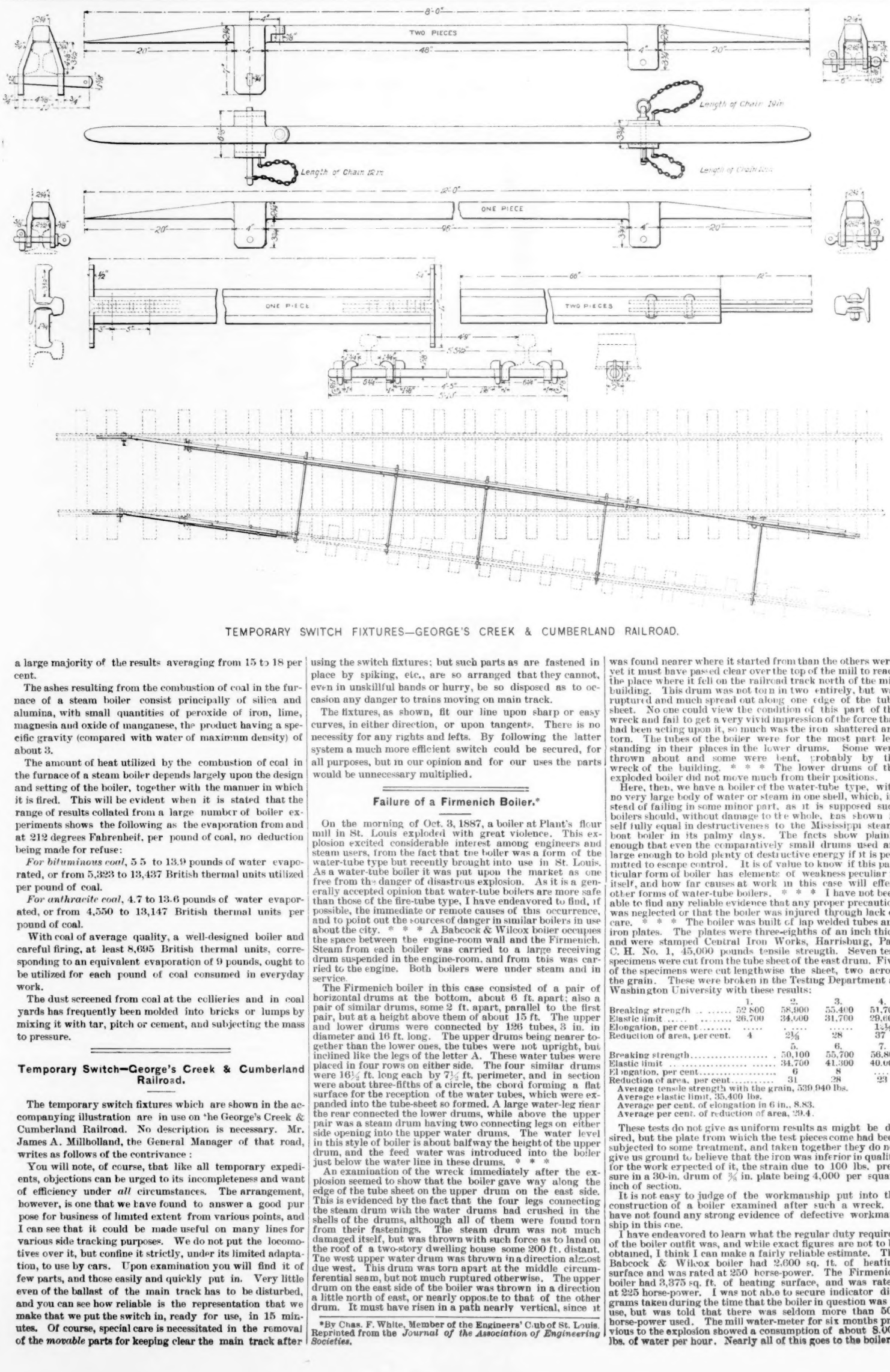
If the volatile products of bituminous coal are expelled by heat, the residue is called *coke;* either *gas coke*, the substance remaining in gas retorts after distillation, or *oven* or *pit coke*, formed in a manner analagous to that employed for the production of wood charcoal. There are some mines of natural coke in Virginia, the volatile portions of the coal having been expelled by the heat given out from a superincumbent mass of trap rock. The composition of oven or pit coke is as follows, parts by weight in 100 :

	Dry and fresh.	Average composition after exposure to the air.
Carbon	92 0	84.8
Sulphur	0.5	0.7
Ash	7.5	7.5
Moisture	....	7.0

The *apparent specific gravity* (that is, the weight as determined by experiment of the coal in merchantable shape, compared with the weight of an equal volume of pure water at the temperature of maximum density) of the principal varieties of coal used in the United States will be found serviceable in designing coal bins and bunkers, and is presented in the following table, the figures representing the averages of a large number of experimental results.

Kind of coal.	Weight. Lbs. per cu. ft.	Cubic feet of space in— One gross ton.	One net ton.
Bituminous Caking	49.28	42.0	37.5
Bituminous Non-caking	52.91	42.3	37.8
Anthracite	53.30	45.5	40.6

The amount of incombustible solid refuse, or ash, contained in coal—the average values of which are shown in a preceding table—is generally greater, in practice, than the weight determined by analysis, for the reason that the combustion of coal in a furnace is seldom complete, some of the carbon remaining unconsumed, either incorporated or mixed with the ashes. An examination of the records of several hundred boiler experiments shows quantities of ashes varying from $3\frac{5}{10}$ to 26 per cent. of the total weight of coal used;



TEMPORARY SWITCH FIXTURES—GEORGE'S CREEK & CUMBERLAND RAILROAD.

a large majority of the results averaging from 15 to 18 per cent.

The ashes resulting from the combustion of coal in the furnace of a steam boiler consist principally of silica and alumina, with small quantities of peroxide of iron, lime, magnesia and oxide of manganese, the product having a specific gravity (compared with water of maximum density) of about 3.

The amount of heat utilized by the combustion of coal in the furnace of a steam boiler depends largely upon the design and setting of the boiler, together with the manner in which it is fired. This will be evident when it is stated that the range of results collated from a large number of boiler experiments shows the following as the evaporation from and at 212 degrees Fahrenheit, per pound of coal, no deduction being made for refuse:

For bituminous coal, 5 5 to 13.9 pounds of water evaporated, or from 5,323 to 13,437 British thermal units utilized per pound of coal.

For anthracite coal, 4.7 to 13.6 pounds of water evaporated, or from 4,550 to 13,147 British thermal units per pound of coal.

With coal of average quality, a well-designed boiler and careful firing, at least 8,695 British thermal units, corresponding to an equivalent evaporation of 9 pounds, ought to be utilized for each pound of coal consumed in everyday work.

The dust screened from coal at the collieries and in coal yards has frequently been molded into bricks or lumps by mixing it with tar, pitch or cement, and subjecting the mass to pressure.

Temporary Switch—George's Creek & Cumberland Railroad.

The temporary switch fixtures which are shown in the accompanying illustration are in use on the George's Creek & Cumberland Railroad. No description is necessary. Mr. James A. Millholland, the General Manager of that road, writes as follows of the contrivance:

You will note, of course, that like all temporary expedients, objections can be urged to its incompleteness and want of efficiency under *all* circumstances. The arrangement, however, is one that we have found to answer a good purpose for business of limited extent from various points, and I can see that it could be made useful on many lines for various side tracking purposes. We do not put the locomotives over it, but confine it strictly, under its limited adaptation, to use by cars. Upon examination you will find it of few parts, and those easily and quickly put in. Very little even of the ballast of the main track has to be disturbed, and you can see how reliable is the representation that we make that we put the switch in, ready for use, in 15 minutes. Of course, special care is necessitated in the removal of the *movable* parts for keeping clear the main track after using the switch fixtures; but such parts as are fastened in place by spiking, etc., are so arranged that they cannot, even in unskillful hands or hurry, be so disposed as to occasion any danger to trains moving on main track.

The fixtures, as shown, fit our line upon sharp or easy curves, in either direction, or upon tangents. There is no necessity for any rights and lefts. By following the latter system a much more efficient switch could be secured, for all purposes, but in our opinion and for our uses the parts would be unnecessary multiplied.

Failure of a Firmenich Boiler.*

On the morning of Oct. 3, 1887, a boiler at Plant's flour mill in St. Louis exploded with great violence. This explosion excited considerable interest among engineers and steam users, from the fact that the boiler was a form of the water-tube type but recently brought into use in St. Louis. As a water-tube boiler it was put upon the market as one free from the danger of disastrous explosion. As it is a generally accepted opinion that water-tube boilers are more safe than those of the fire-tube type, I have endeavored to find, if possible, the immediate or remote causes of this occurrence, and to point out the sources of danger in similar boilers in use about the city. * * * A Babcock & Wilcox boiler occupies the space between the engine-room wall and the Firmenich. Steam from each boiler was carried to a large receiving drum suspended in the engine-room, and from this was carried to the engine. Both boilers were under steam and in service.

The Firmenich boiler in this case consisted of a pair of horizontal drums at the bottom, about 6 ft. apart; also a pair of similar drums, some 2 ft. apart, parallel to the first pair, but at a height above them of about 15 ft. The upper and lower drums were connected by 126 tubes, 3 in. in diameter and 16 ft. long. The upper drums being nearer together than the lower ones, the tubes were not upright, but inclined like the legs of the letter A. These water tubes were placed in four rows on either side. The four similar drums were 16½ ft. long each by 7½ ft. perimeter, and in section were about three-fifths of a circle, the chord forming a flat surface for the reception of the water tubes, which were expanded into the tube-sheet so formed. A large water-leg near the rear connected the lower drums, while above the upper pair was a steam drum having two connecting legs on either side opening into the upper water drums. The water level in this style of boiler is about halfway the height of the upper drum, and the feed water was introduced into the boiler just below the water line in these drums. * * *

An examination of the wreck immediately after the explosion seemed to show that the boiler gave way along the edge of the tube sheet on the upper drum on the east side. This is evidenced by the fact that the four legs connecting the steam drum with the water drums had crushed in the shells of the drums, although all of them were found torn from their fastenings. The steam drum was not much damaged itself, but was thrown with such force as to land on the roof of a two-story dwelling house some 200 ft. distant. The west upper water drum was thrown in a direction almost due west. This drum was torn apart at the middle circumferential seam, but not much ruptured otherwise. The upper drum on the east side of the boiler was thrown in a direction a little north of east, or nearly opposite to that of the other drum. It must have risen in a path nearly vertical, since it was found nearer where it started from than the others were: yet it must have passed clear over the top of the mill to reach the place where it fell on the railroad track north of the mill building. This drum was not torn in two entirely, but was ruptured and much spread out along one edge of the tube sheet. No one could view the condition of this part of the wreck and fail to get a very vivid impression of the force that had been acting upon it, so much was the iron shattered and torn. The tubes of the boiler were for the most part left standing in their places in the lower drums. Some were thrown about and some were bent, probably by the wreck of the building. * * * The lower drums of the exploded boiler did not move much from their positions.

Here, then, we have a boiler of the water-tube type, with no very large body of water or steam in one shell, which, instead of failing in some minor part, as it is supposed such boilers should, without damage to the whole, has shown itself fully equal in destructiveness to the Mississippi steamboat boiler in its palmy days. The facts show plainly enough that even the comparatively small drums used are large enough to hold plenty of destructive energy if it is permitted to escape control. It is of value to know if this particular form of boiler has elements of weakness peculiar to itself, and how far causes at work in this case will effect other forms of water-tube boilers. * * * I have not been able to find any reliable evidence that any proper precaution was neglected or that the boiler was injured through lack of care. * * * The boiler was built of lap welded tubes and iron plates. The plates were three-eighths of an inch thick and were stamped Central Iron Works, Harrisburg, Pa., C. H. No. 1, 45,000 pounds tensile strength. Seven test specimens were cut from the tube sheet of the east drum. Five of the specimens were cut lengthwise the sheet, two across the grain. These were broken in the Testing Department at Washington University with these results:

	1.	2.	3.	4.
Breaking strength	52 800	58,900	55,400	51,700
Elastic limit	26,700	34,000	31,700	29,600
Elongation, per cent	.....	.....	.....	1¼½
Reduction of area, per cent.	4	2½	28	37
	5.	6.	7.	
Breaking strength	50,100	55,700	56,800	
Elastic limit	34,700	41,300	40,000	
Elongation, per cent	6	8	.....	
Reduction of area, per cent	31	28	23	

Average tensile strength with the grain, 539,940 lbs.
Average elastic limit, 35,400 lbs.
Average per cent. of elongation in 6 in., 8.83.
Average per cent. of reduction of area, 29.4.

These tests do not give as uniform results as might be desired, but the plate from which the test pieces come had been subjected to some treatment, and taken together they do not give us ground to believe that the iron was inferior in quality for the work expected of it, the strain due to 100 lbs. pressure in a 30-in. drum of ⅜ in. plate being 4,000 per square inch of section.

It is not easy to judge of the workmanship put into the construction of a boiler examined after such a wreck. I have not found any strong evidence of defective workmanship in this one.

I have endeavored to learn what the regular duty required of the boiler outfit was, and while exact figures are not to be obtained, I think I can make a fairly reliable estimate. The Babcock & Wilcox boiler had 2,600 sq. ft. of heating surface and was rated at 250 horse-power. The Firmenich boiler had 3,375 sq. ft. of heating surface, and was rated at 225 horse-power. I was not able to secure indicator diagrams taken during the time that the boiler in question was in use, but was told that there was seldom more than 500 horse-power used. The mill water-meter for six months previous to the explosion showed a consumption of about 8,000 lbs. of water per hour. Nearly all of this goes to the boilers,

*By Chas. F. White, Member of the Engineers' Club of St. Louis. Reprinted from the *Journal of the Association of Engineering Societies.*

and they also use some condensed water, but I cannot from this source find warrant for assuming that 500 horse-power was regularly required of these boilers. Probably on the average the evaporation per square foot of heating surface from these boilers was about 2 lbs. an hour, a rate which cannot be regarded as excessive. But there may have been times when they were overcrowded, and also we cannot tell just what proportion of the whole each boiler performed. The opinion of the engineer was that the Babcock & Wilcox boiler did the larger share of the duty.

It will be noticed that the drums at top and bottom are not of a circular section, but are flat on one side; in the case of this boiler, the flat part being nearly the diameter of the drum. Two such drums are connected by straight water tubes in four parallel rows. The whole of this structure is subjected to internal pressure. This pressure, acting on the area of the open tubes, tends to force the drums apart, making a tensile strain on the expanded joints. The internal pressure also makes an effort to bring the drum into a circular cross section. The resisting force opposed to this is also the expanded tube joints. It will also be seen that the real net effect of the internal pressure is to cause a pull upon the outer row of tubes considerably greater than would be the case with the fire tubes of a shell boiler spaced in the same way. The more so since the pressure tending to bulge the flat tube sheet acts through a longer lever arm than does the resisting tube.

But a more serious cause of severe strains in this structure is that of the unequal heating of the water tubes in various parts of the boiler, these water tubes being so fixed at the ends as not to be free to move.

I think it plain that two causes contribute to this result. The first is that the fire in such a boiler is near one end, exposing the nearest tubes to a very intense and direct heat. Where four rows are used, as in this boiler, two of the rows are well shielded from radiant heat, and are also well out of direct current of hot gases. In the boiler in question, all tubes that have failed and required replacing were a little back from the front end and in the row next the fire. Internal incrustation is another cause of overheating, which, in this boiler, means undue expansion, and hence severe trains.

All persons examined agreed in the statement that heavy firing or unusual heat, such as is caused by breaking down a fire, always caused a strong pulsation of the water level in the glass gauge; the water sometimes disappearing and then raising 12 to 15 in. with a regular wave motion. I have elsewhere noted a jet like pulsation in the flow of mingled steam and water from a heated tube. Should such motion ever leave a tube partially free of water, as can readily be imagined in a tube of a length of more than 50 diameters exposed to high heat, the scale would be at once hardened on the internal surface. That the scale does so harden to such a degree as to very nearly fill the tubes in Firmenich boilers, is a well known fact to users of that boiler in St. Louis. Here, then, are to be found the causes of the disastrous failure of this boiler. * * * It is to be noted that when any form of water-tube boiler is used where the water contains scale-producing elements, this scale is very liable to be deposited on the walls of the tubes, and it is not easy to remove it when once hardened. A fire tube receives its deposit of scale on the outside while hot and expanded. Cooling down, as during cleaning, tends to loosen such scale. With a water tube the reverse is true. The scale is deposited on the inside while the tube is expanded, and upon cooling the incrustation is firmly held by the contracted tube. Cases have occurred in St. Louis, I believe, where it was easier to replace the tubes than to get the scale out of the inside, where it was held almost like solid stone. Under such conditions it becomes very important that the distribution of heat be uniform in amount on the tubes, especially on those in proximity to each other, or that the tubes be free to expand without setting up strains in the structure of the boiler.

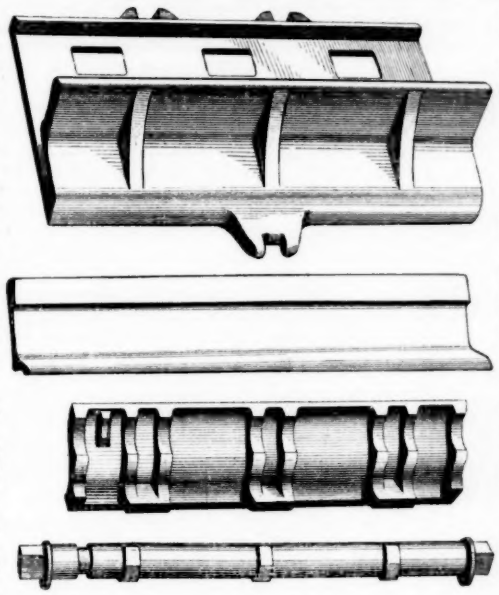
I have thought it worth while to compare the boiler under discussion with one or two other forms of the water-tube type in the points specially noteworthy. These are distribution of heat and freedom of expansion. Reference has been made to the Babcock & Wilcox boiler, of which quite a number are in use in the city, and which is typical of several other makes. With this boiler the tubes are in sets, each set extending from the top to the bottom of the tube system, the tube of each set being connected by a steel casting. Each set then is free to expand independent of those alongside In this style of boiler the heat of the fire is nearly equal across the entire width of the boiler, and the hot gases crossing the length of the tubes three times bring a reasonably uniform degree of heat to bear on every tube.

Another typical boiler is the Heine. The tubes of this boiler all terminate in the flat tube sheets, but these tube sheets are in such shape as to permit of proper staying. The water-legs of this boiler are, perhaps, to some degree free to spread apart at the lower ends, but cases are not wanting where the tubes have been very much buckled by undue expansion. The course of the hot gases in this boiler is such as to heat the lower tubes much more than the upper ones, although, as with the Babcock & Wilcox type, the heat received by the tubes in each horizontal series is nearly equal. The greatest expansion is thus produced in those tubes that are least resisted by the plates of the tube sheets.

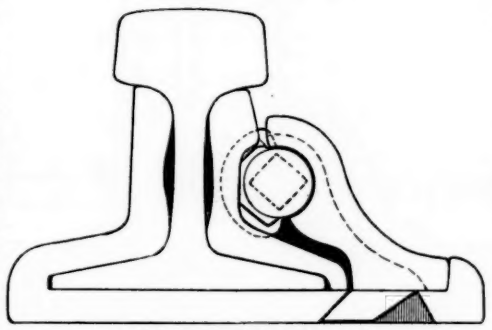
The Van Wie Rail Joint.

The rail joint shown in the cuts herewith is an attempt to combine the advantages of a chair joint, supporting the base of the rail, and a splice joint supporting the head, thus directly holding the rail to line and surface. It will be seen that the joint consists of four parts, which, using the nomenclature of the makers, are the "chair," the "cam-piece," the "hook-piece" and the "gibb-piece." The rail is held in place in the chair by the hook-piece, which has lugs engaging in slots in the base of the chair. An angle-plate, called the gibb-piece, bears against the rail, and the cam-piece works between the hook-piece and the angle-plate. This cam-piece is provided with three cams, as seen in the illustration. The rail being in place in the chair, the hook-piece and cam-piece are put in. The angle-plate is then slipped into place, and by a turn of the cam-piece the cams are brought to a firm bearing. It will be noticed that each cam has three facets for the purpose of preventing the lock from slacking back. A wrench is provided for turning the cam-piece.

It will be seen that this joint is entirely without bolts and nuts or other small parts. This is one of the advantages claimed for it by the makers. Another point of special merit which they claim is the bearing for the base and head of the rail, and the lateral support. It will be obvious, however, that to secure this general support the joint and rail must fit very accurately. Of course some of the objections to any chair joint will lie against this one. No holes in the rails are required.



Perspective View of Parts.



Section, as applied to 80-lb. rail.

The Van Wie Rail Joint.

The chair is 15 in. long and 8½ in. broad, and the whole joint is made of malleable iron.

The joint has been used on 1½ miles of track, for several months past, on 8 deg. curves and gradients of one per cent., and there it has given a smooth and satisfactory track. It can be put in or taken out in about one minute. Two of the joints have been in service in the East Albany yards for over a year, sustaining all the passenger traffic, and the rail ends are in better condition than when the joints were put in. These joints are applied to rail 12 years old. Other trial lots are in use or have been ordered.

Further information can be obtained from the Van Wie Rail Joint Co., of Troy, N. Y.

Specifications for Rails and Track Fastenings.

The following specifications are those adopted by Messrs. Frank Ward & Brother, rail inspectors, of Pittsburgh, Sept. 1, 1888. They are, of course, subject to modification to suit the individual requirements of different customers.

Specifications for Steel Rails.

The steel used for rails shall be made in accordance with the Bessemer or open-hearth process, and contain not less than thirty nor more than fifty one-hundredths of one per cent. of carbon, and not more than ten one-hundredths of one per cent. of phosphorus.

Determinations of the amount of phosphorus, manganese, sulphur and silicon shall be made, when desired by the inspector, and the results of such determinations shall be furnished inspector. The results of the carbon test of each charge shall be given to the inspector.

Upon request of the inspector, physical tests of each charge shall be made. Either drop test or that of a test-bar ¾ or 1 in. thick and about 10 in. long, bent cold to an angle of 90 degrees, without fracture.

The section of the rails shall conform accurately to templates furnished to contractor.

The weight of rails shall be kept as near as possible to standard weights.

The place and date of manufacture shall be marked in plain letters and figures on the side of the web of each rail. The number of charge shall also be plainly marked on each rail.

The ends of rails shall be sawed square and smooth.

The length of rails at 60 deg. F. shall be kept within ¼ in. of standard lengths.

Rails shall be straight in all directions, without twist, and free from gag marks.

Circular holes shall be drilled—not punched—through the web of rail at equal distances from the upper surface of flange and lower surface of head. Distance from centre to centre of holes and from end of rail to be according to drawings furnished to contractor. Holes to be clean drilled, leaving no burrs.

All rough edges at the ends of rails and at the drilled holes shall be well trimmed off and filed.

The space between the web of rails and the template representing the splice bar shall not be less than ¼ of an inch nor more than ⅝ of an inch.

The rails must be smooth and compact, and free from flaws, honeycombs and blisters.

The causes for a temporary rejection of rails are: 1. Crooked rails. 2. Imperfect ends, which after being cut off would give a perfect rail of one of the standard lengths. 3. A variation of more than ¼ in. from standard lengths. 4. Missing test reports.

The causes for a permanent rejection of a rail as a first-class rail: 1. A bad test report. 2. The presence of a flaw of ¼ in. in any part of the rail. 3. A greater variation between the rail and splice bar than specified above. 4. The presence of such other imperfections as may involve the possibility of the rail not giving good service in track.

Specifications for Track Fastenings.

All splices, bolts and spikes are to be made strictly in accordance with drawings furnished to contractor.

All the iron to be tough and fibrous, of uniform quality throughout, free from flaws, blisters and cracks, and must have a workmanlike finish.

Splices.—All iron for splice bars must be capable of sustaining an ultimate stress of 45,000 lbs. per sq. in., with an elastic limit of not less than 20,000 lbs. per sq. in., and an elongation of not less than 12 per cent., measured on a length of 8 in. All holes for splice bolts must be punched *from the inside of the splice bar.* Special care must be exercised to have all edges of splice bars well and accurately defined, and that the outside surface of the web part of the same be perpendicular to the line of the base of the bar.

Bolts.—All iron for bolts must be capable of sustaining an ultimate stress of 46,000 lbs. per sq. in., with an elastic limit of not less than 23,000 lbs. per sq. in., and an elongation of not less than 15 per cent., measured on a length of 8 in., and should be capable of bending to at least a right angle without showing any sign of fracture. The nuts must be tapped to fit threads on bolts accurately. The face of nut must be at right angles to axis of bolt.

Spikes.—The iron for spikes to be tough and fibrous, of uniform quality throughout, free from flaws, blisters and cracks; they must have a workmanlike finish, and be capable of sustaining an ultimate stress of 45,000 lbs. per sq in. with an elastic limit of not less than 20,000 lbs. per sq. in., and an elongation of not less than 12 per cent., measured on a length of 8 in., and should be capable of bending double without showing any sign of fracture.

In all cases test pieces are to be furnished inspectors whenever required.

Manganese Steel.

During the autumn meeting of the Iron and Steel Institute of Great Britain, held at Edinburgh, Mr. R. A. Hadfield read an interesting monograph bearing the above title. After referring to the early knowledge of alloys composed of manganese and steel, he proceeded to detail some recent developments.

Ferro-manganese—an iron alloy containing 75 per cent. of manganese and the material used in the manufacture of manganese steel—is now produced readily and cheaply, its price per ton having been reduced from $600 to $45 by gradual improvements in the process.

In the early experiments made with manganese steel, it was found that if as much as 2½ per cent. of manganese was incorporated with steel, the product became extremely brittle; and the experiments were discontinued. Recently the experiments were continued, and it was found that adding quantities of manganese to steel, up to 6 per cent., very brittle products resulted, but that if the proportion of manganese was doubled, a very tough alloy was produced, having many advantages over ordinary grades of steel, but being so hard that it could not readily be worked by machine tools. By increasing the proportion of manganese beyond 15 per cent., the toughness is decreased.

Manganese steel is cast with great facility, but it cools very rapidly and contracts more than ordinary steel, so that special precautions must be taken in forming ingots.

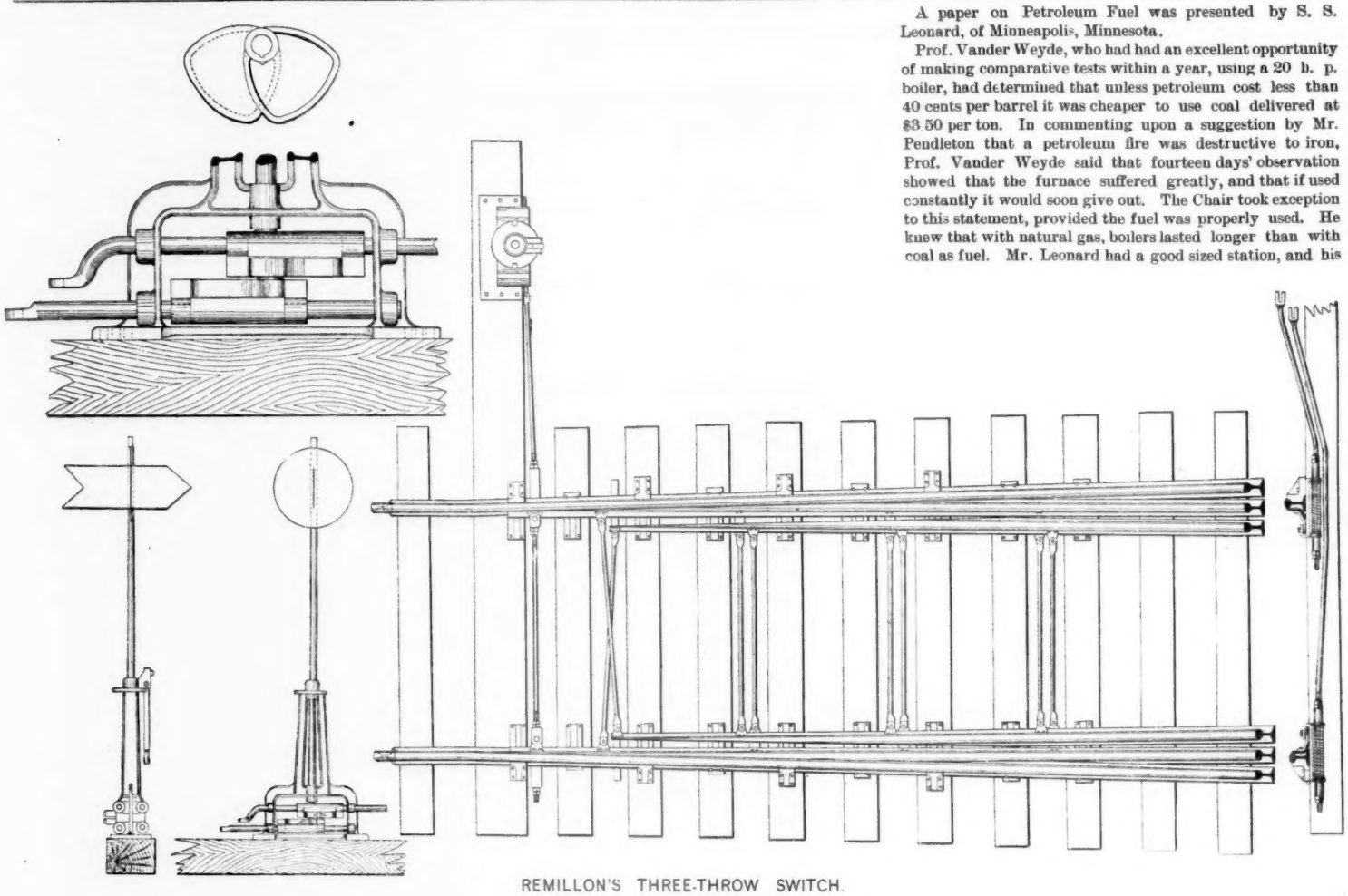
Another curious fact was determined by the experiments with this alloy. It was found that the toughness could be greatly increased by heating the material up to a temperature between 1,800 and 2,000 degrees Fahrenheit, and then plunging it into cold water. It is used by Mr. Hadfield's firm in making the Janney car coupler, and some tests, consisting of blows from a falling weight of 2,324 lbs. upon the jaws of the castings, fixed in a vertical position, are of interest. All of the couplers of which tests are given in the following table, except the one of American malleable iron, were made at the works of the Hadfield Steel Foundry Co.

SET IN INCHES CAUSED BY BLOWS.

Energy of blow. Foot-tons.	American malleable iron casting.....	Mild steel casting (Carbon 0.25 per cent.)	Manganese steel.		
			Just as cast. (Manganese, 9.37 per cent.)	Water-toughened.	
				Manganese, 9.75 per cent.	Manganese, 14.25 per cent.
43.57	0.90 broke	0.35	0.20	0.25	0.15
96.79	.....	0.65	0.35 broke.	0.40	0.35
180.82	.....	1.05 broke.	.....	0.60	0.50
236.84	.....	.....	.....	0.65 not brok'n	0.55
320.87	.....	.....	.....	.....	0.65 not broken.

The effect of cold upon manganese steel castings seems to be inappreciable, and the same is true of heat up to temperatures of 400 deg. Fahrenheit. This alloy has also been tested as a shaft-bearing, with good results. The statement of Mr. Hadfield, in relation to the use of manganese steel for the tires of car wheels, is reproduced below:

"The difficulty was at once met with that, if the wheel was cast in one piece, although exceedingly tough, it is hard to the tool throughout, and it is impracticable to bore out the boss. Attempts were made to cast, in the boss, soft steel or iron bushes, but this was generally unsuccessful, owing to the contraction splitting the boss when cooling. A more successful method has been that of casting the wheel in two



REMILLON'S THREE-THROW SWITCH.

Made by the KANSAS CITY SWITCH & FROG CO.

parts, then bolting or otherwise fastening them together; or that of casting in the hard tire wrought iron or soft steel arms, onto which an ordinary soft steel boss, which could afterwards be bored, was cast. In either of these cases the tires are readily trued or ground up, as practiced in America. Wheels of this class have been used with satisfactory results. On the Nottingham tramways a set ran over 30,000 miles under severe conditions, the gradients averaging as much as 1 in 18 for about one-half the route of the daily journey. In this case a particular point was noticed, viz., that whereas the cast-iron wheels are liable to slip when going down an incline, the chilled brake-blocks bite much more effectively on manganese wheels, enabling the car to be stopped sooner. The Chester Tramways Co. has had a set running for over two years, which up till now have run over 45,000 miles, and are not yet worn out. Wheels of this description can be tested with more than 100 blows with a sledge hammer without fracture occurring, and at the same time the tire is so hard that a chisel will not touch it. A set put to work in America has already run 200,000 miles, under heavy engines of the Consolidation type, on the New York & New England Railroad. The life of ordinary chilled iron wheels does not average more than 50,000 miles."

The records of numerous tests of manganese steel are given in Mr. Hadfield's paper, and it is stated that the alloy is almost entirely non-magnetic. An example is given of a resistance coil containing 1,180 yds. of manganese steel wire (No. 8. Birmingham wire gauge, 14 per cent. of manganese), which gave a resistance of 65 ohms and carried 80 ampéres without overheating; a result which would have required from 5,000 to 8,000 yds. of iron wire, or 4,780 yards of German silver wire.

Manganese steel has been tested for corrosion with mild open-hearth steel, and after both had been subjected to the influence of acidulated water for the same length of time, the losses in grains per square inch of exposed surface were as follows:

	Grains.
Manganese steel, 13 per cent. manganese.	17.27
Mild steel, 0.16 carbon, 6.8 manganese.	17.37

Remillon's Three-throw Switch.

The illustrations of the Remillon three-throw switch, which are given herewith, require but little explanation. It will be seen that there are two cams keyed to the vertical shaft of the switch stand. These cams operate yokes which are fast to the throw-rods. When the lever is moved from the first notch to the second, one throw-rod will be moved while the other remains stationary and locked in position; but when the lever is moved from the second notch to the the third, the throw-rod moved by the first motion of the lever will be locked in that position, and the other one will move forward in turn. Thus it will be seen that when the lever is in the central notch, the switch is set for the centre track, and when moved to the right, the right-hand switch will be opened, and when moved to the left, the left-hand switch will be opened.

It will be seen that the whole construction is simple, and that the locking of one switch while the other is being thrown is positive and secure so far as the stand is concerned.

The clips are all riveted to the web of the rail, and no connections are carried through the web of one rail to get to another.

This switch is in use in the Union Depot Yard at Kansas City, and the makers give a list of eight important Western roads and one Eastern, which are using it. It is made by the Kansas City Switch & Frog Co., and blue prints or any further particulars will be furnished by that company.

The National Electric Light Association.

The eighth semi-annual meeting of this association was held in New York Aug. 29, 30 and 31. It was attended by 300 members and visitors. The proceedings were opened at noon, on Aug. 29, with an address by President Samuel A. Duncan, of Pittsburgh. At the February meeting of this year in Pittsburgh, it was estimated that there were in operation 4,000 isolated plants and central stations, operating 175,000 arc and 1,750,000 incandescent lamps in the United States. By additions since that time the total had been brought up to 5,351 plants and stations, operating 192,500 arc and 1,925,000 incandescent lamps, requiring 459,495 horse-power. The coal consumed for this work in 1888 would make a solid column 100 ft. square and over a mile high. There are in operation 34 electric railroads, with an aggregate of 138 miles of single track, operating 223 motor cars and requiring 4,180 horse-power. There were also in process of construction 49 additional electric railroads, with 189 miles of single track, to be equipped with 244 motor cars. There was difficulty in obtaining exact statistics regarding the stationary motor business, but its growing importance was shown by the fact that single establishments employing 1,500 hands were engaged in their manufacture.

The President then introduced Mayor Abram S. Hewitt, of New York, who made an admirable address of welcome. The Mayor, as a member of the State Subway Commission, has resolutely taken the ground that the electric wires in the streets are not so dangerous as the newspapers have endeavored to show, and that it is folly to endeavor to force the arc lighting companies to place their wires underground until it has been proved that it can be done. He alluded to the fact that a responsible corporation is now drawing into the new conduits an eight-conductor cable for arc lighting. This will not only test the question of feasibility, but whether the business will pay under such conditions.

In February, 1887, upon the suggestion of a member who was interested in insulated wire, a committee of the Association was appointed on Insulation and Installation of Plants. At the present meeting this committee reported that practically nothing had been accomplished. There was an apparent objection to recommending any particular insulation.

experiments had been conducted nine months. Mr. Morrison, of Baltimore, stated that in a proposed enlargement of their central station, he should fit up a battery of boilers for the use of petroleum.

The second day, Aug. 30, was devoted to the question of Underground Wires. The leading paper was by Dr. Schuyler S. Wheeler, Electrical Expert of the New York Board of Electrical Control, on "Overhead and Underground Wires in New York." Notwithstanding the impression that underground wires were a common thing in other cities, especially abroad, nothing had been done which would serve as a precedent for New York. In many places wires had been laid underground singly, in pipes, in sewers and in cables, but no such piecemeal plan could be allowed in a city having more electric conductors and apparatus, and less available area in proportion to the business than any other spot in the world. The ground is so filled with gas, water, steam, sewer and pneumatic pipes with their connecting boxes and manholes, that it is impossible to find a straight course for a conduit, while continual repairs going on make them specially liable to injury. The earth is saturated with gases which collect in such open spaces as the subways and manholes, destroying cables, suffocating workmen and leading to explosions. If it were not for the gas the underground problem would be greatly simplified. As the life of the best cable underground is not satisfactorily determined, the "drawing in" system was considered the most satisfactory and was finally approved. After thorough investigation of the different materials it was finally decided that a conduit was merely a mechanical protection, while the electrical protection or insulation could be safely left to the manufacture of cables. With this understanding, iron gas pipes have since been adopted, embedded in concrete, which prove to be thus far the best system of construction. The conduits and the brick man-holes with which they connect are water-tight, so far as rain is concerned, but the condensation of moisture has not yet been provided against, and the question whether to protect the joints of the conductors or dry out the whole system by a ventilating process is not yet decided. There are now 420 miles of single duct laid down, and there are in operation underground about 4000 miles of telephone and telegraph wires, and several hundred miles of incandescent electric light conductors. The Metropolitan Telephone Company gives the following mileage of its single wire underground conductors in the city: Brooks system, 200 miles; Patterson cable, 3,303; Edison system, 194; total, 3,697. There will also be put down in September and October about 12,000 miles. Number of miles in Brooklyn, 2,100. There are already underground in New York more electrical conductors than in any city in the world.

Mr. E. G. Acheson, of Pittsburgh, read a paper on "Disruptive Charges, and their Relations to Underground Cables." Mr. Alexander C. Chenoweth read a "Description of an Underground Conduit" made of Portland cement concrete, a sectional core being used as a mandrel, forming a continuous

duct. These three papers were discussed conjointly, although attention was concentrated upon that of Dr. Wheeler, whose assumption that the underground problem was solved from an electrical standpoint is antagonistic to the officially expressed opinion of the association as reiterated from time to time, and which took the form on this occasion of the following resolution, which was unanimously adopted.

Resolved, That the National Electric Light Association, after a full discussion of the subject, decide to express their hearty sympathy with the views expressed by His Honor, Mayor Hewitt, in his address before the Association upon the subject of putting wires underground, and in addition desire to take this opportunity of expressing the opinion that up to the present time no commercially practical method has been brought to their notice by which high tension direct currents such as are used for arc lighting can be placed underground.

The meeting adjourned on Aug. 31, to meet in Chicago next February, the exact date to be fixed by the Executive Committee.

The Tests Applicable to Rails.

BY JAMES E. HOWARD, C. E.

The tensile test furnishes for general purposes by far the most information obtainable from any one test, and when its indications are properly interpreted, far-reaching results are obtained. Other kinds of tests are made which have special reference to questions of design and the proportions of parts of the structure. It is to this class that transverse and compression tests usually belong, although it sometimes happens that these tests can be fully understood only by means of the tensile results of the same metal. Bending tests are useful and very easy to make, and from the fact that they may be made almost anywhere, the full significance of their results should be understood. It is highly desirable to know the relative behavior of material under these simple tests with the more elaborate ones which require special machinery for their manipulation.

The Drop Test.—It is very important that the details of this test may be made as complete as possible, and that the same metal be tested in other ways to establish the true meaning of the results. While this is a bending test it is not usually spoken of as such, bending tests so-called being restricted to small hand specimens. It is highly probable that drop or impact tests are capable of furnishing practical and scientific data of unusual importance beyond what have yet been developed. Just at present, however, there appears to be some doubt about the reliability of drop tests, which comes about in an indirect manner, it having been found in the case of axle metal that while material which gave good results under the drop proved good in service; and that on the other hand some material which did not behave well under the drop also gave good service. The conclusion was drawn that the drop test did not satisfy the conditions of a strictly reliable test. As material which would be rejected on account of failure under this test having proved good in service it might be possible that some material would prove bad after having successfully passed that test. Experience may show in the course of time just what rigidity of drop test is essential to secure a metal entirely trustworthy for railroad purposes.

Within the elastic limit the modulus of elasticity is that property which fixes the ability of the metal to resist shocks. A high elastic limit, combined with a low modulus of elasticity, furnishes conditions favorable for the maximum resistance against shocks without causing permanent set or flow of the metal. Now, it is possible to elevate the elastic limit of a metal by varying its chemical composition or by mechanical treatment, but means have not been discovered by which the modulus of elasticity may be permanently lowered. Overloading will generally cause a temporary reduction. Careful observations do not show the modulus of elasticity to have a fixed value, although the variations are confined to comparatively narrow limits. When a value is stated for steel departing much from 29,000,000 to 30,000,000 lbs. per square inch, the results should be confirmed by further tests. Values one-third higher than these have been stated by apparently good authority; neverthless, it is believed these high results were reached through some error. In practical testing with the drop, it seldom happens that attention is given to the behavior of the metal within the elastic limit, and therefore some of the questions just discussed apparently do not arise, although the elastic part of the resistance is, of course, a more or less important part of the entire resistance, when each blow of the ram causes increased permanent set.

The relative ability of different metals to transmit or distribute stresses beyond the parts directly receiving the shock would seem to be an important feature in the drop test, if that is found to show superiority or inferiority where other tests fail. On this point available data seem inconclusive. We do know, however, that under tensile tests the metal immediately responds to the influence of the load while within the elastic limit, and under higher loads there is considerable sluggishness in acquiring the full elongation which the load is capable of causing. This sluggishness of flow has been attributed to the breaking up of internal strains and successively bringing all the parts of the metal into a state of homogeneity under stress, wherein an even state of tension over the entire cross-section results, which may be the case for loads exceeding the elastic limit only a small amount. It has hardly been proved, however, that overloading wholly removes internal strains, although it may change their relative positions. We are probably safe in saying that this sluggishness is primarily due to internal friction.

The efficiency of the drop test is in part due to the reversal of stresses which may be given the metal by giving the rail one-half a turn after each blow of the ram. The reversal of the stresses could be given in any transverse test, however. In fact if the drop test is superior to all other tests, as believed by some, its superiority must consist in its dynamic effects, in other respects results may be obtained by methods wherein just what is done is more definitely known.

Hardness Tests.—There is another class of tests which might be made use of to advantage, namely, hardness tests. Tests by this method are made by means of a pyramidal shaped cutter which indents the metal under a certain pressure; 10,000 lbs. having been adopted, which gives a hardness of 3.33 for gun metal, a rather soft bronze. The amount of metal displaced by the cutter is the measure of its hardness, the hardness increasing inversely as the metal displaced. Hardness by this method depends upon the elastic limit and the resistance to flow, reinforced as it is by surrounding metal not strained above the elastic limit. This is believed to be the best method of determining hardness yet introduced. Of course the shape of the cutter and the pressure applied may be changed in different cases if desired, as the object of such a test is to obtain comparative results.

Such are the mechanical tests which are in use or may be applied to testing rails. They have each been briefly explained, and from this it may be seen through what channels information of the physical properties of rail metal comes independent of the wide field of track experience and observation. From the latter source comes almost exclusively our knowledge of the durability of the metal as regards abrasion and wear.

Strength and Hardness.—Within limits, the questions of durability and of strength are not antagonistic, although the feeling generally prevails that while increased hardness may improve the metal against abrasion and also increase the tensile strength, yet this end will be accompanied by a degree of brittleness incompatible with a safe material. It seems to be true that when the hardness is increased by varying its chemical composition there is an increased tendency to brittleness, and it is not quite certain that methods of cold treatment whereby the elastic limit is elevated till it approaches very near the tensile strength of the metal do not also have a similar tendency, particularly if the metal is left in a state of intense local internal strains. It must be confessed that experimental data upon this part of the problem of what is the best rail metal are very meagre, and in the absence of exact information there is great difficulty in assigning true values to the different properties, those which contribute toward and those which detract from the durability of the metal under the complex conditions which are met in the track.

Internal Strains.—That part of the subject which relates to the state of the metal as regards internal strains has not yet received its proper share of attention. Internal strains exist in almost every piece of metal, in some to such an extent that their presence is manifested to the most casual observer; in other pieces of metal the internal strains are practically extinct, yet their presence may be detected by delicate apparatus. Unequal rate of cooling and local stresses both cause permanent internal strains; that is, when the local stresses exceed the elastic limit. The magnitude of these strains may range from zero to the elastic limit of the metal. The higher the elastic limit and more brittle the material the nearer internal strains approach the tensile strength. When these internal strains exceed the elastic limit either the metal takes a permanent set and stretches, or rupture ensues. The edges of sheared plates furnish examples where permanent sets are given, and where only local stretching occurs at a distance from the edge. On almost any sheared steel plate there will be found lines on the surface oblique to the edge, extending 8 to 10 in. into the plate where the scale has been disturbed by the act of shearing. This illustration is chosen because it shows how differently may be the action of strains exceeding the elastic limit and those below it. Whereas within the elastic limit the internal strains very probably are equally (or nearly so) distributed through the material in the affected vicinity, when the elastic limit is exceeded the permanent sets may be confined to narrow limits, and the narrower the zone in which stretching occurs the greater the probability that rupture will be reached by means of these strains. Why the metal chooses to stretch locally along these lines is perhaps on account of some parts having slightly lower elastic limits than others, and when stretching begins at one point the strains of adjacent parts are more readily relieved at this place than elsewhere, and thus other portions contribute to the stretching, and there is concentrated at the extremity of this line intense stresses from adjacent strained parts. If this is the true explanation of the formation of these lines of broken scale, it may be readily understood that these lines might cross without interference just as they actually do under tensile stresses.

When fracture occurs from internal strains the break is a brittle one. This is necessarily so, because a limited display of ductility would relieve the internal strains. Steel bars have been observed in which there was a slight relief of the internal strains, without rupture, after the lapse of a number of weeks' time, as shown by the distortion of the metal which occurred in the meantime. Quite likely most metals reach a state of equilibrium within a few weeks or months after their last mechanical treatment, and after that remain in a more or less strained condition for an indefinite period. If such were not the case, it would seem that any strain, however small, would eventually end in the rupture of the metal. Of course it must be immaterial to any given part of the metal whether the strain on that part results from internal strains in other parts of the same piece, or whether the strain is from an externally applied load.

In reported instances where steel rails have broken while unloading, there were probably internal strains, which would account for the peculiarity of fracture without necessarily attributing the cause of fracture to the shock. The stress at unloading doubtless was the means of causing fracture at that time, although the same result might have been accomplished by means of slowly applied loads. At least, extreme brittleness has been displayed by boiler plate steel under slowly applied stress. After the brittle fracture was made that part of the specimen was bent through 180 degrees cold, without fracture; the plate was three-fourths of an inch thick.

In order to guard against injurious internal strains the processes of manufacture and of finishing the rails should be carefully inspected. There is no method known by means of which the presence of internal strains may be ascertained without cutting up the metal and noting the distortions which follow. The causes which tend to produce internal strains may, however, be studied, and the subject so well determined that there need be no reasonable doubt whether or not such strains exist. It then is simply a question whether the railroads will adopt the necessary precautions to avoid, to a certain extent, their introduction, or continue to take their chances in this respect. It is not expected there will be a complete elimination of internal strains in finished rails, and perhaps the means necessary to materially reduce them would be regarded as onerous. However this may be, a little more information on the subject would soon enable the question to be decided how much may be feasible in this direction.

Chemical Analysis.—Concerning chemical analyses, of course no one believes that such analyses must not be made. The question is whether the chemical composition shall be left entirely with the steel makers, the roads stating what physical properties are required, or whether specifications shall state in general or specifically what the chemical composition must be. Although the requirements of rails seem to be entirely physical, and if they are met and the rails give good service their chemical composition may, for the time being, be a matter of indifference to the roads, still that is not the whole story. All the data relating to the rails should be in possession of the railroad. The road has opportunity to collect all data relating to the wearing qualities, and whether the conditions of traffic are successfully met. It has the opportunity of taking out rails from time to time and examining their structure to find whether appreciation or deterioration of properties has taken place. In fact, the most valuable opportunities rest with the railroads, and if these opportunities are improved the rail mills would, through these means obtain the most trustworthy data for their guidance. Whatever benefits accrued would be shared by the roads to a greater extent than the mills. Then again, it is important to know what is a suitable grade of metal and the best form of rail for a given traffic. Having a knowledge of the composition of good and also of inferior rails does not carry with it the necessity of specifying the chemical composition. This kind of knowledge ought to be in the possession of but used with considerable caution by the railroads. If at a later time it is established that a certain composition is the best, or that several are equally good, then this part of the subject will occupy a more prominent position outside of the steel works than at present. What chemical composition is with the steel makers, mechanical properties are with the railroads. Some very eminent authorities specify what the composition of rails shall be, still there appears much force to the opposing arguments that equally good rails may be made outside of the specified limits.

Density.—The subject of density is often referred to as a means by which good quality and thorough working of the metal may be identified, and as indicative of the ability of the metal to withstand abrasion. This may, in a measure, be true. Nevertheless a metal cannot be judged by its density alone, other data being absent. The fundamental principles which govern the density of a metal we are unable to understand, although the methods by which changes in density may be affected are readily ascertained by experiment. If there is visible porosity it is very evident that increased density will result when such cavities are obliterated. It is not so easily understood why certain treatment causes change of density in a metal which to all appearances is sound and free from interstices at the start and so continues throughout our series of observations. Primarily the density of a steel seems to depend upon the amount of iron present. Steels low in carbon and other elements are found to have higher specific gravities than high temper steels. Therefore in these cases density depends upon chemical composition. Examining specimens from the same grade of metal it is found that changes in density may result from mechanical treatment, but the important question, what treatwill produce maximum or minimum results, is not definitely settled. So far as experimental knowledge has reached in relation to changes of density in steel, due to mechanical treatment at atmospheric temperatures, whereby the elastic limit is exceeded and permanent cold flow occurs, it is found that where a decided set is given a change of density results and the impression is conveyed that possibly any such set, even though it be very slight, may change the density to an extent measurable in some cases, in other cases not, at least with present apparatus. It is not improbable that there are some points of similarity between disturbing the metal beyond the elastic limit cold and the strains set up in sudden cooling. A piece of tool steel which in its annealed state is of lower density than a piece of mild steel will have its density still further lowered by the process of hardening. If we were to consider the relative density of different metals in comparison with their ability to resist abrasion and wear, it would be at once seen that density does not in these case exert a controlling influence.

WATERTOWN ARSENAL, Aug. 20, 1888.]

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

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In speaking last week of rail joints, we said that the life of the joint is of little importance *if* it does not save the rail also. In printing *if* became *as*. The error probably misled no careful reader.

The large number of locomotive boiler explosions that have occurred lately cannot all be attributed to low water, that convenient scapegoat for the sins of boiler makers. Thin plates, defective joints and stays, and corrosion have always had far more to do with explosions than any neglect to keep the boiler supplied with water. A locomotive boiler, being especially hard worked and difficult of inspection, should not only possess a good factor of safety when new, but should have ample margin of strength when the plates and stays are weakened by corrosion. This is too often neglected, and lap joints that are bent backward and forward every time steam is raised are frequently placed beneath the water line. The consequent furrowing could be avoided were the joints which are subjected to strain placed above the water line and made with double butt straps, which put a direct pull on the plate and do not tend to bend it. The bending action is generally concentrated along one line, and the scale being flaked off, the metal is exposed to the corrosive action of the water every time steam is raised. Careful investigations into the records of boiler explosions show that the majority of explosions are caused by local corrosion or furrowing. The use of higher pressures calls for improved design and increased care in the manufacture of locomotive boilers.

The Pennsylvania Railroad has just opened Johnstown, Pa., to western traffic at Pittsburgh rates. Johnstown is 78 miles east of Pittsburgh, on the Pennsylvania main line. The chance is now given its merchants to buy produce and sell goods in Chicago on even terms with its rival. Pittsburgh firms cannot be supposed to rejoice at this enforced equality, but they have for a long time been able to ship eastward at the same rates as Johnstown, and turn about is but fair play. The necessity of the railroad situation doubtless was the occasion for this extension of the grouping system. We believe it to be a fact that at the time of the passage of the Inter-state law more places were put upon an exact equality with basic points than before. Perhaps in the railroad millennium each manufacturing or producing section will be put upon the same footing in all competitive markets, regardless of distance. Opposed to this theory of transportation is the mileage plan, which is at the bottom of some of the complaints made by Detroit and other cities against existing tariffs. Between these two theories of grouping and mileage there is an irrepressible conflict, with odds at present in favor of the former.

The recently published tariffs of the Transcontinental Association have been accepted by the Western lines, but the Eastern trunk lines and the Central Traffic Association roads appear from latest reports to have decided to charge full Missouri River rates on California freight. On some articles these tariffs make a higher rate between Chicago and San Francisco than between New York and the Pacific Coast, and on other articles the same rate. The trunk lines objected to this as violating the long and short-haul sections of the law, while the Pacific roads fell back upon water competition as a sufficient reason for them. Traffic Manager Stubbs, of the Southern Pacific, is reported as holding that this ocean route between the Atlantic and the Pacific would justify any higher rate on interior shipments which the railroads might see fit to charge, but Chairman Cooley calls attention to the position of the Inter-state Commission that such higher rates must be only reasonably higher, if not indeed the same, for the longer haul. The association has conceded that on such goods as are manufactured in Chicago, the rates to the Pacific shall be not higher than from New York, but the Chicago jobbers in Eastern goods are shut out of the competition. There is talk of a complaint before the Inter-state Commission. This is an instance of the leveling process now so apparent Chicago has held that no railroad can or should make any rates throughout the Mississippi Valley without regarding her natural advantages, but exactly this argument is now turned against Chicago. The ocean affords the same advantages to Boston and San Francisco as the lakes to Chicago. If the claim of Chicago to be mistress of interior tariffs be admitted, the claim of San Francisco to the lowest rates must be allowed also.

The Inter-state Commerce Commission has apparently just discovered that a great many railroad accounting officers do not make daily use of the "Saratoga Classification" of operating expenses. A pamphlet containing this classification, with some slight necessary modification, has just been issued to guide the railroads in making returns. As such things go, the Saratoga classification is a good one. We have no particular objection to its adoption as a sort of general model; but we do most strongly object to the attempt to force upon all railroads the expense of conforming to every detail of a schedule which is at best somewhat arbitrary. We do not believe that the public will gain anything at all corresponding to the trouble. In fact, we think that the Commission is pursuing a false course in attempting to subdivide every detail for the purposes of the statistician. Can anything be imagined which is more purely arbitrary than to subdivide the cost of filling ice-houses into three equal parts, charging one to passenger trains, another to freight trains and a third to station supplies? Sometimes the line of separation becomes ludicrously narrow; but the Commission is none the less strenuous concerning its importance in such cases. We are told that "the articles coming under the head of repairs of buildings must not be confounded with those embraced in station supplies." The conscientious railroad officer will find much to puzzle him when he comes to apply the distinction. He will find that freight trucks are repairs of buildings, while wagons are station supplies. Ashpans are repairs of buildings, brooms are station supplies; hammers are repairs of buildings, nails are station supplies; lamps are repairs of buildings, lanterns are station supplies. We do not deny that there is a certain principle underlying the general distinction of the two sources of expense. But we have grave doubts whether there is any object to be gained which warrants all this effort at uniformity of detail. A single effort at manipulation of the returns will upset all the results of spending hundreds of dollars in separating the details. This manipulation may arise either from the desire of accounting officers to conceal the truth from the Commission, or from the incapacity of the agents of the Commission itself. We are not thoroughly assured against this latter danger. The Commissioners themselves are busy with cases, and must of necessity leave much of this part of their work to subordinates. The men who classify yardmasters, freighthouse foremen and other persons filling positions of this sort as "unskilled laborers"—which the classification before us does in so many words—are not to be trusted to make generalizations from railroad returns which have been arbitrarily divided into minute details.

In the test case of the Rock Island against the Iowa Commissioners, Judge Fairall has sustained the injunction preventing the Commission from putting their schedule into force Not merely is this decision an important one, but the statement of the grounds on which it is based is remarkably strong. It is argued that the Court has jurisdiction of the subject matter of the action, because, while the Commissioners are authorized to exercise a discretion in fixing the rates, when they fix such rates that the earnings are too low to enable the plaintiff to pay fixed charge and operating expenses, then their acts contravene the spirit of the statute, which requires rates to be reasonable and just, and is in violation of the constitutional provisions which entitle the common carriers to a reward for their services. The Court further holds that the Legislature has no authority to establish rates which are not compensatory, and that if such rates are promulgated, a court of equity has the right to inquire into the matter. This is involved in the right of such a court to control the actions of public officers and to prevent them from acting in violation of the law.

It is interesting to compare the series of decisions to-day with those of the years 1873–77 and note the change of ground of the two parties. In the earlier period the railroads sought to deny the right of the state governments to regulate railroad charges. They insisted that railroad property was substantially like any other property in this respect, and that the Legislature had no special authority over it. On this ground they were beaten. The decisions of the United States Supreme Court in the Granger cases established the doctrine of public use as part of the law of the land, and sustained the right of special regulation. To day the legislatures assume that the right of regulation means the right of unlimited regulation, while the railroads are contending, not against the right as such, but against the unrestrained exercise of that right. In this they have been pretty uniformly successful. Private property dedicated to public use may be subject to special obligations; but it does not thereby lose all its rights as private property. The state authorities may make the mistake of supposing that it does; but it is gratifying to find that the courts take a much more sensible and conservative view of the matter.

The Pennsylvania and all its controlled roads, both east and west, have returned to the old method of car service settlements, thus giving the death blow to the present experiment with the combined per diem and mileage system, which was begun so hopefully a year ago. The circular of President Roberts making this announcement says that the move "is made necessary by the withdrawal from the per diem system of our principal connections and the larger lines of the country, thus destroying the reciprocity of the service, which is essential to a proper interchange of cars." The Pennsylvania still believes that the per diem system is correct in principle, and that when generally participated in, it will secure "a more prompt movement and larger returns from the cars than can be obtained by the old mileage system." The announcement states that the Pennsylvania will, "for the present," discontinue, etc., which would seem to indicate that the management has hopes of securing more effective co-operation at some future time. The lack of determined and vigorous effort in the line of this reform on the part of prominent roads is probably mostly attributable to the fact that more important matters have crowded this one out of consideration. But this is hardly a permanent valid reason, for, if money can be saved, and important economies and conveniences in traffic be brought about by the use of an improved system, it would seem clear that independent efforts should be made to inaugurate such a system. The fact that the presidents and general managers are deeply engrossed with rate difficulties and financial affairs of magnitude, should not hinder progress in this department. It is hardly reasonable to suppose that men capable of dealing with the problem cannot be found if sought after. A bright prospect of saving some thousands of dollars in direct car-service payments, of getting additional work out of cars owned, or of getting the use (for improvements) of large sums of money which will otherwise go for new cars to be used up more by weather than by wear, is too important a thing to be neglected. That all these and still other advantages have been in sight on many roads during the past year is undisputed, and it is to be hoped that the Pennsylvania's disposition to make the present halt only temporary will be shared by many other roads. Within a few days the General Manager of the Pennsylvania has been reported to have said that his company is more occupied with the problem of getting cars to handle the traffic offered than with that of getting paying rates for what is handled. Perhaps if more of the great companies were in that fortunate condition the per diem system would make headway.

Some Functions of the Brick Arch and Extension Smoke-box.

The brick arch and the extension smoke-box have in common one very valuable feature which is sometimes overlooked, though well known to those who

have studied the question of locomotive coal consumption most carefully. The deflector plate, possible only in the extension smoke-box, is used, because it secures a tolerably even draft through all the flues, while with the ordinary blast-pipe the greater part of the products of combustion pass through those flues which terminate nearest the nozzle of the blast-pipe.

The brick arch fulfills a similar equalizing function in the fire-box, and when properly placed exercises a very beneficial influence in distributing the draft evenly over the entire area of the grate. Electricity has made all familiar with the term "short circuit,"

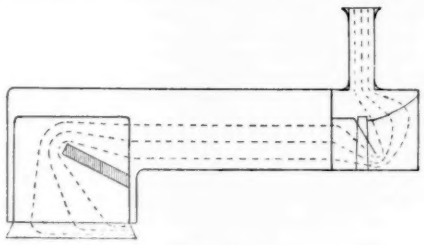

Fig. 1.

and currents of gas have, like electricity, a disposition to take the shortest path.

A cylinderful of exhaust steam as it issues from the blast-pipe acts as a piston, more or less perfectly filling the upper part of the smoke-box and the stack, and drives the air and gas before it. The vacuum thus created must be supplied from the nearest available source, and with a high nozzle, the top flues, being nearest the point where the greatest vacuum exists, furnish the bulk of the supply. This is doubtless one reason why very small nozzles give the best results when placed tolerably low down, while a large single nozzle which does not presumably create such an intense local vacuum does well when placed higher up where a small nozzle would fail to make an engine steam. The effect of the small exhaust nozzle has in actual practice to be counteracted and the draft distributed and equalized by using two nozzles and placing them low down where their greatest effect is nearly opposite the centre of the nest of flues.

The deflector plate used in the extension smoke-box, however, gives a much better distribution of the draft, for the simple reason that the vacuum is created at a point more nearly equi-distant from all the flues and that the tubes nearest the bottom of the deflector are those where the draft is most impeded by cinders, which naturally, owing to their gravity, take the lower flues, while the hot gases rise to the top.

The great size of the extension front also fulfills another useful duty, that of equalizing the draft during the whole period of a revolution. It is obvious that if the smoke-box was very small, a momentary but considerable vacuum would be created by the piston of exhaust steam rushing up the stack. If, for instance, the cubic contents of the smoke-box were only equal to that of the stack, and the exhaust drove before it all the gases in the stack, the volume of gases in the smoke-box would expand to double their volume, and thus create a vacuum of 14 or 15 in. of mercury. If, on the other hand, as is usually the case, the contents of an ordinary smoke-box is five times that of the stack, the five volumes of gas in the smoke-box would expand to six when the piston-like jet of exhaust steam had reached the top of the stack. This would give a vacuum of only some 5 in. of mercury. It need hardly be pointed out that such a vacuum is never attained, because the gas in the flues rushes into the smoke-box to supply the vacuum, but the tendency toward creating such a vacuum exists, and the relative effects of the proportion of cubic contents of stack to smoke-box have a somewhat similar relation to the vacuum created in the smoke-box. The larger the smoke-box the less intense the maximum vacuum produced by each beat of the engine, but it by no means follows that the *average* vacuum is impaired. It is evident if the size of the stack and the volume and pressure of the exhaust remain unaltered, the volume of the gases swept out of the stack by the exhaust will not only not be diminished, but that the exhaust considered as the piston of a vacuum pump will be more effective, insomuch that it will not have to work against such a difference of pressure. A jet of exhaust steam working against a difference of pressure of several pounds to the square inch, would prove a leaky and inefficient piston, but is tolerably tight and effective against a difference of pressure of 5 6 ounces per sq. in., which the experiments of Messrs. Wynkoop and Wolff showed to be the average vacuum in the smoke-box of a Jersey Central passenger locomotive.*

* See *Railroad Gazette*, page 538, Aug. 17, 1888.

It is not therefore surprising that the extended smoke-box is valued not only for the convenient and efficient manner in which it retains sparks, but for the even and well-distributed draft which it secures.

A properly proportioned fire-brick arch carries the equalization of the draft a step further and distributes it evenly over the entire area of the grate. The tendency of the current of air and gas to take the shortest path it also manifest in the fire-box, and is illustrated by the fact known to every fireman that running with the back damper open is apt to burn the fire thin under the fire-hole door, the air taking the shortest course through the fire to the flues.

The accompanying diagram, fig. 1, shows clearly the difference in the length of the path of the air in fire-boxes, with and without a brick arch where the front damper only is used. The diagram shows in dotted lines the path of the air through; 1, the front portion of the grate; 2, the middle, and 3, the back of the fire. Without a brick arch the distance from the three different points to the mouth of the flues would differ materially, but with the brick arch, the course of the air is equalized and the draft is evenly distributed all over the grate.

The diagram, fig. 2, shows the effect of a brick arch in a somewhat long and shallow fire-box with an inclined grate. The front part of the fire, where the ash and clinker collect, are very properly least influenced by the draft. Without a brick arch the draft would be strongest there, just where it is not required.

It is also evident that an alteration in the angle of the arch will have an effect on the rate of combustion at any part of the grate. If the fire burns sluggishly under the firehole door, the draft on that portion of the grate can be increased by lowering the point of the arch, while any undue tendency to burn into holes at the back end can be met by increasing the angle of the arch and so increasing the distance from the grate bars to the point at which all the products of combustion must turn the end of the arch on their way to the flues. The proper length and angle of an arch depend on many considerations, but one main requisite is to secure a tolerably even draft upon all parts of the grate.

The length of the arch also influences the equal distribution of the draft amongst the flues. If the arch be lengthened and the point raised nearer the crown of the box, the path of the gases to the lower flues will be lengthened and the tendency of the gases to take the top flues will be increased. The deflector or baffle plate in the extension smoke-arch can, however, be more effectively used to distribute the draft equably among the flues. It is evident that if the deflector is shortened, the length of the path of the gases from the top flues is also reduced and consequently it may be expected that a larger portion of the products of combustion will pass through the higher tubes.

When an engine is running, it may be argued that it is very difficult to determine, even approximately, the relative quantity of the products of combustion passing through the upper, lower and middle flues. We may, however, ascertain the distribution by results. If certain alterations in the forms and inclinations of the brick arch and deflector improve the steaming power of the engine, and lessen the number

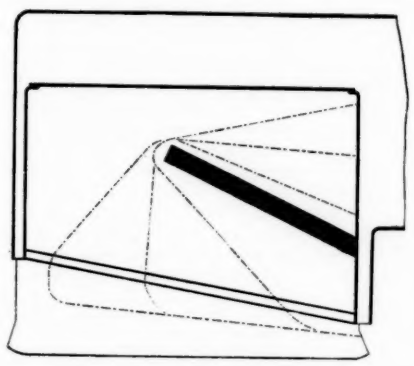

Fig. 2.

of sparks and the temperature in the smoke-box, the result is mainly attained by a more even distribution of the draft, which does not cut and lift one particular part of the fire but spreads the most active combustion all over the grate. The effect in lessening sparks is obvious, while it is equally plain that 200 flues worked to their full capacity will make more steam than if the draft through many of them is excessive, while in others it is practically inoperative. The latter case is virtually one of insufficient heating surface, and it is attended with the usual results, a high smoke-box temperature, a small blast orifice and a large consumption of coal.

It is often assumed that the extension front is merely a convenient spark receptacle, but an examination of the principles on which it acts leads to the conclusion that its claims to be regarded as equalizing the draft are also substantiated. The fact that the brick arch promotes a more perfect commingling of the gases in the fire-box, and, therefore, a more perfect combustion of the coal, is well known, and is now generally acknowledged. While this is the chief advantage of the brick arch, the more even combustion obtained is also important, and has contributed greatly to the favor with which the brick arch is now generally regarded.

The Railroad Year of 1887.

Advance sheets of Poor's Manual for 1888 have been sent out during the week. The volume gives statistics for the year 1887, the first year of the operation of the Inter-state Commerce law, and the year of the greatest amount of railroad building in our history. As the results of operation necessarily can include only the fiscal years of the companies, which ended at various periods during the calendar year, the changed conditions under the new law can have had but little effect on the returns given; and the effect of the new construction had only begun to be felt.

The mileage of main track at the end of the year, and at the end of the fiscal years of the companies, and the increases, are reported as follows:

	Total.	Increase.
End of calendar year 1887	149,913	13,081
End of fiscal years of companies	147,999	14,392
Mileage reporting operations	136,986	11,859

It is stated that the 11,012 miles not reporting consisted mostly of new roads not yet brought into full operation. Reports of operations were received from 92.6 per cent. of the total mileage existing at the close of the fiscal years of the companies. For several years the percentage of the lines reporting has been:

	1887.	1886	1885.	1884.	1883.
Per cent	92.6	93.7	96.3	90.4	88.7

The increase in mileage during the fiscal year was 9.7 per cent.; the increase in mileage from which reports were received was 9.4 per cent.

We have collected in the following table some statistics of operation. The quantities (except, of course, miles operated) are expressed in *millions*.

	1887.	1886.	1885.	1884.	1883.
Miles operated	136,986	125 147	122,110	113,173	106,939
			—Millions.—		
Passeng'r train-miles	239	211	212	207	188
Freight "	394	350	342	335	350
Mixed "	11	9	6	....	....
Total revenue	644	570	560	541	538
Passengers carried	428	382	351	335	313
Passenger-miles	10 570	9,660	9,134	8,779	8,541
Tons carried	552	482	437	399	400
Ton-miles	60,061	52,802	49,152	44,725	44,065
Gross Earnings—					
Passengers	$241	$212	$201	$207	$207
Freight	637	550	510	503	540
Total	941	822	765	763	807
Net earnings	331	297	266	267	292
Dividends on stock	90	80	78	93	102

As compared with 1886 the increase in mileage operated was 9 4 per cent., while the traffic increase was as follows: Passengers carried, 12 per cent.; passenger-miles, 9.4 per cent.; passenger earnings, 13.7 per cent; tons of freight carried, 14.5 per cent.; ton miles, 13.7 per cent.; freight earnings, 15.8 per cent. From these figures it follows that the average journey or haul decreased both for passengers and freight, while the rates per unit increased; and from the comparative figures published it appears that the rates per passenger-mile and per ton-mile were the highest since 1884, while the average haul of freight and the average passenger journey were the shortest recorded in the tables of the Manual.

The table reprinted below gives financial and traffic statistics per mile of road, as well as other information of great interest.

The increases per cent. in passenger and ton miles, and in miles operated, for five years, have been:

	1887.	1886.	1885.	1884.	1883.
Pass.-miles	9.4	5.7	4.0	2.8	14.1
Ton-miles	13 7	7 4	9.9	1.5	12.1
Miles operated	9 4	2 4	8.0	5.6	11.5

The very great relative increase of the freight business is apparent. That is, while the passenger-miles have increased in the same ratio as the miles of road operated, the ton-miles have increased 1.46 times as fast as the mileage. The increase in passenger and freight earnings for four years was:

	1887.	1886.	1885.	1884.
Passenger	13.7	6.0	Dec 2.9	Same.
Freight	15.8	7.8	1 4	Dec.6 8

The traffic *per mile of road* operated in the last five years was as follows:

	1887.	1886.	1885	1884.	1883.
Pass.-miles	77,163	77,187	74,190	77,570	79,876
Ton-miles	438,448	421,920	399,250	395,190	412,100

It will be seen that in density of traffic the passenger movement remains about constant, while that of freight has increased steadily. Of course it will be borne in mind that none of these statistics include the

	1887.	1886.	1885.	1884.	1883.	1882.
Completed road:						
Capital stock per mile	$ 28,321	$ 29,935	$ 29,867	$ 30,064	$ 30,759	$ 30 674
Bonded debt per mile	28,290	29,062	29,453	29 317	28,650	28,268
Cost of road and equipment	52,699	54,301	55,059	55,329	55,461	52,726
Road operated:						
Passenger earnings per mile	1,756	1,694	1,612	1,801	1,651	1,926
Freight earnings per mile	4,649	4,397	4,219	4,382	5,092	4,824
Gross earnings per mile	6,861	6,570	6,265	6,663	7,461	7,377
Net traffic earnings per mile	2,444	2,376	2 185	2,318	2,702	2,670
Percentage of expenses to earnings	64.45	63.84	65.12	65.21	68.78	63 61
	$	$	$	$	$	$
Earnings per pass. train mile	1.008	1.006	0.949	1.001	1.11	1.14
Earnings per freight train mile	1.615	1.573	1.518	1.502	1.56	1.59
Earnings per revenue train mile	1.444	1.443	1 366	1.410	1.50	1.55
Expenses per revenue train mile	0.931	0.921	0.892	0.918	0.96	0.98
Net earn. per revenue train mile	0.514	0.522	0.474	0.492	0.54	0.57
Percentages of gross earnings:	per cnt.	per cent.	per cent.	per cent.	p r cent.	per cent.
Passenger	25.82	25.77	26.9	27.1	26	26
Freight	68.38	66.94	67.4	65 9	67	67
Other	5.80	7.29	5.7	7.0	7	7
	cents.	cents.	cents.	cents.	cents.	cents.
Earnings per passenger-mile	2.276	2.181	2,198	2,356	2.422	2.514
Earnings per ton-mile	1.063	1.042	1.057	1.124	1.236	1.236
	miles	miles	miles	miles	miles	miles
Average passenger journey	24.68	25.27	25.99	26.24	27.32	25.89
Average haul per ton	108.79	109.49	112.46	112.07	110.04	109.02
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Interest per cent. of bonds	4.71	4.75	4.77	4.66	.....	.....
Interest per cent of bonds and debt	4.55	4.53	4.62	4.51	4.59	4.40
Dividends per cent. of stock	2.18	2.04	2.02	2.48	2.75	2.91
Interest and dividends per cent. of stock, bonds, and debt	3.49	3.26	3.36	3.52	3.68	3.65

greater part of the new road built last year in thinly settled regions.

From the table above it will be seen that the percentage of expenses to earnings was greater than in 1886, although less than in any other year since 1882. The increase last year has been expected from the evident tendency of many of the most prosperous roads to charge betterments to operating expenses. The operating expenses per mile were:

1887.	1886.	1885.	1884.	1883.	1882.
$4,417	$4,194	$4,080	$4,345	$4,759	$4,707

and the net earnings per mile were greater than in any year since 1883. The actual decrease in operating expenses per mile since 1882 and 1883, in face of the great increase in business done, and of the heavy expenditures last year for maintenance and betterments charged to operating expenses, is a pretty certain evidence of increased skill and care in conducting the business.

At the close of the fiscal years, the mileage, capital stock, bonded debt and unfunded debt of the roads reporting were as given in the following table:

	Mileage.			Capital stock, millions of dollars.		
	Miles.	Inc.	P.c.		Inc	P.c.
1887	147,999	14,392	10.1	$4,191.6	$191.1	4.8
1886	133,607	5 878	4.6	3,999.5	181 8	4 8
1885	127,729	2,577	2.0	3,817.7	55 1	1 4
1884	125,152	4 600	3.8	3,762 6	54.5	1.4
1883	120,552	6,091	5 2	3,708 1	197,1	5.6
1882	114.461	.....	.....	5,511.0	.....	.....
Increase in 5 years	33,538		29.3	.....	680.6	19.4

	Bonded debt, millions of dollars.			Unfunded debt, millions of dollars.		
		Inc	P.c		Inc. or Dec.	P.c.
1887	$4,186.9	$303.9	7.8	$294.7	$14.0	4.9
1886	3,883.0	117.3	3 1	280.7	21.6	8.3
1885	3,765.7	96.6	2.6	259.1	14 5	5 9
1884	3,669 1	168.2	4.8	244.6	D. 24.4	9.0
1883	3,500 9	265 4	8.2	269.0	D. 1.2	0.4
1882	3,235.5	.....	.....	270.2	.....	.....
Increase in 5 years	951.4		29 4	.....	24.5	9.1

This table shows still more strongly than the similar one which we made last year the change in the proportions which the different forms of liability bear to each other and to the properties. It is seen that while the mileage has increased 29.3 per cent. in five years the capital stock has increased but 19.4 per cent. and the bonded debt has increased 29.4 per cent. The small increase in stock and great increase in bonds were more marked last year than before. This condition will naturally recur in those years in which the new construction is largely in extensions by old corporations.

The decrease in capitalization per mile, and in bonded debt and cost of road per mile, as shown in the table which we have reprinted above, should be noticed. Notwithstanding this decrease it appears probable that the roads have increased in actual value per mile. The new road is said to have been generally well built; heavier rails have been laid, both on old and new roads, than in the past, and we know that great sums were spent last year in rebuilding and strengthening bridges, filling in trestles, laying new rail, and other improvements. The decrease, therefore, in the figures which represent the liabilities and the assets per mile of road must be accounted for otherwise than by an actual decrease in value. Low prices of material have had something to do with it, no doubt, and payments for improvements out of surplus earnings have also been an element in the change.

While the mileage operated increased 9.4 per cent. the locomotives increased 5.5 per cent., and the number of cars increased 12.8 per cent.

The heaviest capitalization per mile is in the middle group of roads, and the lightest in the South Atlantic. The heaviest and lightest earnings per mile are in the same groups respectively. Taking the Southern roads as a whole, however, the gross and net earnings per mile increased in 1887 over 1886 more than did the average earnings of the whole country. In the Southern states the increases in gross and net earnings were respectively $357 and $119 per mile, while the averages of the whole country increased but $291 and $68 per mile.

A locomotive with the Strong valve gear and boiler is now nearly completed, and will shortly make some experimental runs upon the New York & New England. The engine was built for the Atchison, Topeka & Santa Fé, and the inventor appears satisfied that a speed of 70 miles per hour can be attained between Chicago and Kansas City when the engine in question is employed to haul the trains. The usual rectangular fire-box is superseded by two cylindrical corrugated Fox furnaces similar to those used on marine boilers working under high pressure. These twin furnaces open into a single combustion chamber, which is also cylindrical and corrugated. The advantages of this form of construction are obvious. Practically, no stays are needed, and the expansion and contraction of the corrugations tends to detach the scale. In this engine the two furnaces are each 42 in. diameter and 7 ft. long. The distance from the firehole to the flue sheet is 16 ft., giving a long flameway. The flues are 11 ft. 5 in. long and the majority are 2 in. diameter, but in order to prevent the bottom flues being choked with ashes, ten in the lowest course are made 3 in. diameter. The cylinders are 19 in. by 24 in. and the four coupled drivers are 69 in. diameter on tread. The valve gear has been described at length in these columns, and the results obtained with a somewhat larger Strong engine, No. 444, on the Lehigh Valley, are doubtless also familiar to our readers.* The latter engine was tested between Mauch Chunk and Sugar Notch, exclusively on up gradients. The results were briefly as follows:

	Grades. Ft. per mile	Weight of train. Lbs.	Speed. Miles per hour	I. H. P.	Consumption. Lbs. per I. H. P.	
					Water.	Coal.
Maximum	96 to 62	451,000	38 8	926	31.0	4.16
Minimum	.....	252,000	28.7	705	25.8	3.38

The weight of train is exclusive of the weight of engine and tender. This engine, No. 444, was of unusual weight for a passenger engine, having six coupled wheels 62 in. diameter on tread and 20 in. by 24 in. cylinders. The total weight of the engine in working order without tender is given as 138,000 lbs. This engine was exhibited at the Master Mechanics' Convention at St. Paul in 1887, and hauled a heavy train on the Northern Pacific. Owing to the defective manner in which the seam between the combustion chamber and furnaces was made, the engine was withdrawn from active service after running some six months. The Adamson seam was subsequently adopted and the engine is now at work on the Lehigh Valley hauling heavy passenger trains.

The old idea of burning gas under a locomotive is again revived. A master mechanic of 30 years experience is said to have reported on the latest scheme for this purpose as follows:

If machines large enough for locomotives are built with a reserve power, it will be a great advantage and saving to burn gas as fuel for railroad purposes. I claim, in the first place, that the saving in burning gas instead of coal will be very great; for with the present system but about 45 per cent. of the fuel is used, 55 per cent. going to waste, while with the proposed method of commingling the gas and air the combustion is so perfect that nothing is lost. One ton of coal will make about 11,000 ft. of gas, which gas commingled with air and burnt by this method will do more railroad work than any two tons of coal, besides giving the company an additional profit from the sale of coke. The next saving, resulting from taking off the back pressure, amounts to 20 per cent. while doing away with the disagreeable noise of the exhaust, adding this strength to the engine. Another advantage to railroad companies is the doing away with all smoke, soot and cinders, thus saving the heavy damages that companies annually pay for property destroyed along their lines.

*The particulars of these experiments, which were made under the direction of Mr. E. D. Leavitt, were given on page 598 of the *Railroad Gazette*, Sept. 16, 1887.

The quantity of producer gas that is generally made from a ton of coal is far greater than the figure stated, which applies to illuminating gas, which is not the most suitable for heating purposes. But even supposing that the figures were correct, the immense space occupied by the gas would be a formidable objection. Taking the figures as given, 33,000 cub. ft. of gas will evaporate as much water as 6 tons of coal, and therefore a tender should provide storage capacity for 33,000 cub. ft. of gas. This would require a reservoir of 9 ft. diameter and over 500 ft. long, which would form rather an extensive tender, especially convenient on curves, and well adapted to enter an ordinary round house.

The speed of many of the long-distance trains west of Chicago has been reduced since the table of speeds between the principal cities was given in a recent issue of the *Railroad Gazette*. The so-called fast trains between Chicago and Kansas City have been withdrawn, and a schedule under the present time card between Kansas City and Chicago would be as follows:

		Fastest train.		
	Route.	Distance. Miles.	Time. H. M.	Speed. Miles per hour.
Kansas City to Chicago	Burlington	487	18.45	25.5
" "	Alton	488	18.45	26.0
" "	Rock Island.	521	18.45	27.9
" "	Santa Fé	458	18.45	24.4

The "Overland Flyer" of the Union Pacific will leave Council Bluffs daily at 7.30 a. m. instead of 12.20 p. m., arriving at Ogden at 9 p. m. the next day instead of 11.30 p. m., as at present. The train will therefore take 2 hours 20 minutes more time, the speed, including stops, being 26.8 miles per hour instead of 28.5 miles per hour as formerly. The train will be slightly accelerated between Ogden and San Francisco, arriving there 2 hours earlier that at present. The other daily train, the Pacific express, will take 47 hours 40 minutes, giving a speed, including stops, of only 21.6 miles per hour.

The Cooke Locomotive Works are about to be moved from the present site near Passaic Falls, in Paterson, N. J., to a more convenient location inside the city limits, but having spur tracks from the Delaware, Lackawanna & Western and the New York, Lake Erie & Western. The inconvenience of having to team all material, as well as the finished locomotives, through the streets is so great, that it is surprising that the three locomotive-building firms at Paterson should still continue in such an inconvenient location. The Baldwin Works are also intersected by public streets, but are better situated as regards proximity to a railroad. The new Cooke works will be carefully laid out and arranged on the most convenient plan that experience can suggest.

The difference of opinion as to the utility of the extension front on locomotives burning hard coal is amusingly illustrated by the following quotation from the *Locomotive Engineer:*

"On the Delaware, Lackawanna & Western, passenger trains are hauled by hard coal burners, having short front ends and diamond stacks. There is more trouble from dirt and cinders in the cars than on many roads using soft coal and using the extension front and straight stack."

The Northern Pacific seems to have won in the struggle to get control of the Red River Valley Railroad. The bill sanctioning the agreement with the provincial government of Manitoba passed the legislature, Aug. 31, by a vote of 27 to 10. The terms on which the road and its extensions are to be transferred to the Northern Pacific have been given in the press dispatches, and some of the conditions of the agreement, as reported, are given in another column. No official information has, however, been given out by the Northern Pacific.

It is said that arrangements will be made to carry on the work on the Cincinnati and Covington bridge night and day, in order that it may be finished by the first of next January. The Phœnix Bridge Co. promises to do the fastest erecting that has ever yet been done on a permanent structure, and the Cincinnati people expect the work to be an additional attraction to their exhibition.

Through rail communication with Constantinople has at last been opened, but in somewhat irregular and unsatisfactory fashion. The matter stands as follows: From Belgrade the capital of Servia, to Constantinople is about 650 miles. About 200 miles at the northern end, and over 300 at the southern, have been in regular operation for some time. The intermediate section, 120 miles in length, is completed but remained for some months unoperated; or, at any rate it did not serve as a means for handling through traffic. It belongs to three different nations—Servia, Bulgaria and Roumelia; the last, in railroad matters, is wholly under the control of Turkey. The Servian section has been ready for some time. The Bulgarian section has just been put into shape. The trouble is in Turkey. The Turkish section was built by one company and was to be operated by another. By the time when it was completed, some months ago, the Turkish government had quareled with the second company, and was unwilling to deliver the road into its hands. The authorities preferred to have the road unused, rather than that it should be used by a company against whom they were engaged in a lawsuit.

The Porte tried to have the road operated by a Servian company, but Bulgaria claimed that this was a violation of the international agreements, and refused to allow the rolling stock of this company to pass through Bulgaria. This deprived the company of the means of performing its con-

tract, and produced a complete deadlock. Finally, about a month ago, the Bulgarian government sent down a train with railroad officials and a few soldiers and took quiet possession of the unused line. Although possessing almost no technical rights in the matter, they issued a time-table, and made arrangements to operate the road as if it were their own, sending a note to Turkey to the effect that the unused line was in danger from brigands, and that they deemed it their duty to preserve the property. It is said that they have some difficulty about arranging for Turkish connections, which is not surprising. Between Turkey and Bulgaria the case looks far from promising, either for the company that wants to operate the road or for the people that want to use it.

Many of the English colonies have tried government management of railroads and have not found it particularly successful. The location of the roads was often unduly influenced by political considerations, and the line was made to pass through A, because the honorable legislator representing that district was an influential supporter of the government, while B, which could be approached by an easier route and was a more promising source of traffic, was neglected because its member had little political influence. The most serious difficulties, however, arose in working the lines, and especially in the choice of officers. The engineer of maintenance of way was easily selected from the civil engineers who came out originally from the old country to survey and build the line. The erector who came out in charge of the first half dozen locomotives became in due course of time the superintendent of motive power, and in some cases was a man of sufficient education and breadth of grasp to fulfill the duties of his position when his department had grown fifty fold. The superintendent of the line was generally, in like manner, the original conductor, guard or station agent. Both these officers, however, having no spur to efficiency in the shape of a competing line, speedily became extremely conservative and were thrown entirely upon their own resources for new ideas. Their difficulties were not lessened by the fact that skilled railroad labor is scarce in the colonies, and that some of the experienced men seeking employment had left a home railroad for some breach of rules. The principal difficulty was found, however, when a general manager was required. It was almost impossible that the necessarily narrow field of a colonial railroad could adequately train such a person and endow him with the wide experience and practical knowledge necessary for such a post. In default, therefore, of a technically trained head, the railroad department of the government was in many colonies administered by a government official, generally of high character and long service as a country lawyer, a justice of the peace, a road trustee or a commissioner of docks and harbors. The results of an utter ignorance of the general principles, much less of the details, of working a large and scattered railroad system, were soon visible. One of the English colonies determined at last to import a general manager who had been brought up in the latest school of large English roads, and Mr. Speight, formerly of the Midland, has done so well in Victoria, and has effected such great improvements in the working of the government lines there, that the neighboring colony of New South Wales has followed the example, and Mr. E. M. G. Eddy, formerly Assistant General Manager of the Caledonian, has just been made Chief Commissioner of the New South Wales railroads. Mr. Eddy has many friends in this country who will wish him success in his new sphere of duty.

The race between England and Scotland still continues, and very fast time is made between London and Edinburgh. The chairman of the London & Northwestern recently informed the stockholders at the half-yearly meeting that his company wished to run in the same time as the other route, which is 8 miles shorter, but the chairman of the Great Northern said he believed the East Coast route, owing to its better grades, was fully capable of running in less time, and apparently proposed to demonstrate this until the West Coast route consented to allow a difference of some 15 minutes in the schedule time. It seems probable that a time-table allowing about eight hours will be ultimately agreed upon, giving a speed, including stops, of about 49 miles per hour. It appears that an engine was built to run from London to Edinburgh in eight hours as long ago as 1853, but the amount of travel and the demand for high speed at that time were not sufficient to warrant the small number of stops which the attainment of such a high speed would necessitate. A somewhat similar race took place in 1848, when trains on the broad (7 ft.) gauge were run as fast as possible in order to demonstrate that a higher speed could be attained than on the narrow, or 4 ft. 8½ in., gauge. The well-known "Flying Dutchman," the first fast express train ever run, was for some years timed to run 53 miles in 53 minutes, and on one occasion ran the distance in 47 minutes from start to stop, an average speed of over 67 miles per hour while in motion, corresponding to a speed of about 73 miles per hour when fairly under way. On another occasion a train weighing 269,000 lbs. without engine and tender, was run the same distance in 50 minutes. The line, however, was singularly straight and level, and this speed was not maintained for any great distance or over long and heavy grades.

The Denver Deep Water Convention adopted the following resolution: "That the states and territories and commercial bodies represented in this convention, approve the idea of securing deep water on the Gulf coast of Texas by private capital, and they do hereby respectfully request their Senators and Representatives and delegates in Congress to labor in this behalf." The President is also asked to make the matter a subject of recommendation in his next annual message.

The Rodgers ballast car and plow, which was described recently in these columns,* has been tried with, it is said, satisfactory results on the Chicago, Burlington & Quincy, where a large party of officers of prominent Chicago roads witnessed its operations spreading and leveling ballast. It is stated that in these tests near Hawthorne station one man distributed 20 tons of ballast along 150 feet of track and spread the same in less than a minute. The spectators are said to have pronounced the trial a success.

NEW PUBLICATIONS.

The *Journal of the New England Water-Works Association* is issued quarterly from the office of the Junior Editor, Mr. Walter H. Richards, New London, Conn. The September issue contains the report of the proceedings of the seventh annual convention held at Providence last June. The papers read and the discussions thereon are also given.

Foreign Technical Notes.

Mr. Roman Abt, inventor of the system of rack-rail and locomotive known by his name, and described in the *Railroad Gazette*, Jan. 7 and 14, 1887, has been awarded a prize of $1,275, by the Society of German Railway Directions, for the above inventions.

The *Swiss Building Journal* gives the following particulars of a concrete highway bridge built last year near Erbach, a station between Ulm and Friedrichshafen in Bavaria. The span was 95 ft.; rise, 13 ft.; thickness at the crown, 1 ft. 7½ in. At each each end of the span the arch is relieved by a superposed arch. The width of the bridge is 19 ft. 8 in. and its total cost about $3,000. The concrete was made of 1 part Portland cement, 1 part sand and 3 parts carefully washed and screened Danube gravel about the size of walnuts. The foundation was a rather poor gravel, and to avoid possible difficulty from settlement the arch was divided into two parts and separated from the abutments by asphalt courses at the spring and crown. These courses are ⅜ in. thick at the extrados and $\frac{3}{16}$ in. at the intrados. The crown joint closed up about ⅛ in. after the centre was struck, and no cracks whatever took place in the concrete.

According to the French official journal, as quoted by the *Journal of Austrian Engineers and Architects*, the French coal and iron industry is in rather a bad way. The number of mines has fallen from 504 in 1885 to 476 in 1886, and only 204 of these are worked at a profit. Putting the iron and coal industry in tabular form, we have the following results, in millions of tons:

	1883.	1884.	1885.	1886.
Coal production....	21.5	20.0	.....	19.5
Cast iron "	2	1.872	1.634	1.508
Wrought iron production.	1.5	1.38	1.336	1.234

The number of steam engines factories is increasing, but only for small engines, while the production of large establishments is decreasing.

The number of steamships has remained stationary. Locomotives have decreased from 9,241 in 1885, to 9,150 in 1886, though 906 miles of new line have been opened.

Sugar in Mortar.

The following note, by Prof. I. O. Baker, appears in the *Selected Papers* of the Civil Engineers' Club of the University of Illinois.

Although saccharine matter has been employed in India as an ingredient of mortar from time immemorial, and reference has been made to it by standard authorities, its effect is not generally known, and it has attracted considerable attention in England and America during the past year.

Sugar unites with lime and forms sucrate of lime, a solid which possesses considerable strength, dissolves freely in water and is acted upon by carbonic acid. All hydraulic cements contain at least 50 per cent. of lime compounds. Hence, if a saccharine substance be added to mortar, the sugar will unite with the lime and form sucrate of lime; the effect of this compound may be an advantage or a disadvantage, depending upon attendant conditions. For example, if the mortar is composed of common lime and sand, the sucrate of lime being stronger than the carbonate, will add to the strength of the mortar; the lime will unite more rapidly with the sugar than with the carbonic acid of the air, and hence the addition of the sugar will also cause the mortar to set more quickly. In India, the practice is to add one pound of the coarsest sugar (or its equivalent in syrup) to each gallon of water with which the mortar is mixed; "this amount of sugar adds one-half to the breaking strength of the mortar and doubles its cohesive strength." It is better to dissolve the sugar in the water instead of mixing it dry with the lime, since some limes in slacking "burn" the sugar, thereby destroying its strengthening effect and also blackening the mortar.

If the mortar is composed of cement and sand, the addition of sugar may increase or decrease the ultimate strength of the mortar, depending upon the amount of sugar present and also upon the relative ultimate strength of the compounds formed. The addition of sugar to cement mortar will also accelerate or retard the setting of the cement, depending (1) upon the relative indurating activity of the sucrate and the silicate, and (2) upon the amount of water used, for while the cement is hydraulic the sucrate is non-hydraulic, and hence the former will set in the presence of water, but the second will not. Either of these facts accounts for the opposite results obtained from different experiments, and also for the fact that some experimenters conclude that sugar is of no advantage with the best qualities of Portland cement.

Sucrate of lime is soluble in water, and hence in time it will be washed out by the rain, therefore, the addition of a saccharine substance to mortar is most beneficial in a dry climate, as India, for example. If lime mortar is used in the interior of thick walls, the addition of a saccharine substance would be beneficial, since mortar thus placed would never * become fully saturated with carbonic acid. The compounds of lime with sugar are attacked by the carbonic acid of the air, and hence the strengthening effect of the sugar is not permanent where the mortar is exposed to the weather.

It is highly probable that essentially the effects obtained by mixing sugar with mortar can also be obtained by the use of gum arabic, dextrine, glucose or starch. The use of such materials in mortar involves some interesting questions. A study of this subject by an engineer chemist might lead to valuable results.

* The Rodgers ballast car and plow were illustrated in our issue of July 27, 1888.

TECHNICAL.

Locomotive Building.

The Baldwin Locomotive Works last week delivered two consolidation locomotives to the Columbus & Western.

The Boston & Albany has received six 60-ton freight engines from the Baldwin Locomotive Works, Philadelphia. Ten engines of this class were received last year.

The Louisville & Nashville has just finished a heavy locomotive at the Louisville shops.

J. & J. B. Milholland, of Pittsburgh, Pa., have begun the building of light locomotives for the general market, and will hereafter make it an important department of their business.

A new locomotive, the first ever built in Cape Breton, has just been completed at Sydney mines, and made her first trip to North Sydney on Monday. The locomotive was made under the superintendence of John Elliott, engineer of the General Mining Association at that place. The locomotive is considered the best of the number owned by the G. M. A., and is named the C. G. Swann.—*North Sydney (C. B.) Herald.*

Car Notes.

The Ohio Falls Car Co., of Jeffersonville, Ind., has delivered three passenger cars to the Minneapolis, St. Paul & Sault Ste. Marie. The company is now completing the last of the cars for the New York, Lake Erie & Western, and will next week commence work on an order for freight and passenger cars for a South Carolina road.

The Alabama Great Southern last week received 12 ore cars from the Anniston (Ala.) works of the United States Rolling Stock Co.

The car works of the Elyton Land Co., Birmingham, Ala., are now in full operation. The company is building some platform cars for the Georgia Pacific and a number of freight cars for the Belt Line of Birmingham.

The Georgia Southern & Florida is receiving a large number of new freight cars.

The new erecting shop of the Haskell & Barker Car Works, at Michigan City, Ind., is three squares long by 117 ft. wide and is one of the largest buildings under a single roof in the country.

The Louisville & Nashville has put in use 100 refrigerator cars leased from the Litchfield Car Works.

The Minneapolis, St. Paul & Sault Ste. Marie has received two sleeping cars from the Barney & Smith Mfg. Co., Dayton, O. Each car contains ten sections, drawing-room, smoking-room and two separate toilet-rooms for ladies. The drawing-room is furnished in white mahogany and upholstered with red plush, while the main body is of mahogany upholstered with olive green plush. The smoking-room is upholstered in russet leather. They will be lighted by Acme lamps, and connections have been provided for incandescent lights, whenever it is found desirable to use them. Both cars will be heated by fire-proof, flexible steel Baker car heaters, and the ventilators, which are of cathedral glass, are so arranged, says a local paper, as to insure a constant current of pure air through the car. This pure air "chestnut" is "limited" in its operation, probably; valid only when the thermometer is 30 degrees below and the train is stalled in a snow bank.

Bridge Notes.

The new Chicago, Burlington & Quincy steel bridge, at Nebraska City, Neb., was formally opened Aug. 30.

The St. Paul & Duluth will build iron bridges over the Snake, Grindstone, Kettle and St. Louis rivers.

The King Iron Bridge Co. have received the contract for building a new iron bridge over the Blackstone River at Fisherville, Mass.

A bridge will be built across Duck River, near Normandy, Tenn., by the Nashville, Chattanooga & St. Louis Railroad.

An iron viaduct, 32 ft. wide and 1,000 ft. long, is to be built on Hawk street, Albany, N. Y. Proposals received until Sept. 29 by the Hawk Street Viaduct Commissioners. P. C. Ricketts, 17 First street, Troy, N. Y., will give information.

The County Commissioners of Wood County have let the contract for building the new iron bridge across the Little Kanawha at Parkersburg, W. Va., to the Wrought Iron Bridge Co., of Canton, Ohio. The cost of the bridge is about $25,000, and it is to be completed by Jan. 1. It is to be a Whipple truss, 296 ft. long.

The Philadelphia City Council will build a bridge over the Reading Railroad at Willow street, Germantown.

The following proposals for the superstructure of the Broadway bridge across Cherry Creek, Denver, Col., 130 ft. span, have been received by H. M. Lane, Constructing Engineer Denver Tramway Co.: P. E. Lane, Chicago, $7,287; King Iron Bridge & Manufacturing Co., Cleveland, $8,627; Milwaukee Bridge Co., Milwaukee, C. E. H. Campbell, Council Bluffs, Ia., $8,950; Shiffler Bridge Co., Pittsburgh, $9,525; Missouri Valley Bridge & Iron Co., Leavenworth, Kan., $9,600; H. A. Tullock & Co., Leavenworth, Kan., $11,500.

Manufacturing and Business.

The Industrial Works, of Bay City, Mich., have recently shipped 15-ton construction and wrecking cranes to the West Virginia Central and to the Southern Pacific. They have also supplied the Boston & Maine with their improved extension steam pile driver. They have at present under construction three heavy cranes, one of 30 tons capacity, and two extension steam pile drivers.

The Mason Regulator Co., of Boston, has recently received an order for 100 reducing valves from the Martin Car-Heating Co., also for a large number of pump pressure regulators from the Whittier Machine Co., for their elevator plants.

The new air compressor made by the Ingersoll Rock Drill Co. of New York, is meeting with much favor. The company has received orders for its compressors beyond the shop capacity. Two large machines, cylinders 20 by 30 in., were recently shipped to the Louisville Water Co., and an order has been received from the Kalamazoo Spring & Axle Co., of Kalamazoo, Mich., for one of the new style compressors to be used for spraying oil in connection with fuel atomizers. The new regulator applied to the Ingersoll compressor

* Lime mortars have been taken from the walls of ancient buildings which were only 50 to 80 per cent. saturated with carbonic acid after an exposure of nearly 2,000 years.

automatically applies and releases the load, accomplishing a great saving in fuel and perfect regularity of action. Another important attachment to this compressor is a crosshead which is so attached to the piston rods that the wearing of the crosshead in the guides does not bring the weight of the crosshead on the rods.

The Jeffrey Manufacturing Co. of Columbus, O., is now filling orders for mining machines for the Union Pacific mines at Rock Springs, Wyo.; the St. Paul, Minneapolis & Manitoba mines at Great Falls, Mont.; Atchison, Topeka & Santa Fe mines in Colorado, New Mexico & Kansas. These drills are capable of boring a hole 6 ft. in diameter in from 3 to 4 minutes. The company has just moved into new works recently completed, where the facilities will be greatly enlarged.

The Buffalo Forge Co., Buffalo, N. Y., last week contracted to furnish forges, blowers, etc., for the School of Mechanical Engineering, Vanderbilt University, Nashville, Tenn. The company is at present working on similar orders from several Southern universities.

The contract for 400 tons of 18-in. cast-iron water pipe at Hyde Park, Ill., was awarded Aug. 28, to Lake Shore Foundry Co., of Cleveland, at $27.35.

Proposals for a wrought-iron freight shed 67 × 132 ft. are asked by J. B. Thomas, Treasurer National Military Home (for Disabled Soldiers), Ohio. Bids must be in by Sept. 14.

Adams & Woodson have the contract for the new $30,000 brick depot of the Norfolk & Western, at Lynchburg, Va.

Messrs. Riehle Bros., proprietors of the Philadelphia Scale and Testing Machine Works, report the following recent orders: Cornwall & Lebanon Railroad, one 200-ton track scale; Woodstock Iron Co., Lebanon, Pa., two 50-ton track scales; Phœnix Iron Co., Phœnixville, Pa., three 30-ton platform scales; American Gas Company, Canton, O., one 6-ton miners' scale. Sulzer & Vogt, Louisville, Ky., one transverse testing machine; Claus Spreckles, Philadelphia, one cement tester; Department of Public Works, New York, one cement tester; Department of Public Works, Trenton, N. J., one cement tester; State College, Texas, one cement tester and one 20,000 pound Harvard testing machine.

Messrs. Norcross Brothers, of Worcester, Mass., have the contract for building the large new passenger stations at Springfield, Mass., and Hartford, Conn. Besides these they are building other stations on the Boston & Albany, and have large contracts for buildings at New Orleans, St. Louis, Omaha, Kansas City, Cincinnati, Syracuse, New York, New Haven, Boston, and other places. They have quarries at Longmeadow and Milford, Mass., and a wood working shop at Worcester. The firm employs over 2000 men and is one of the largest building firms in the country.

The Johnston Car Seat Company, of Chicago, is putting its reclining seats into 16 new passenger cars now in process of construction for the Chicago, Kansas & Nebraska at the Pullman Company's works.

Iron and Steel.

John C. Printup, Rome, Ga., wants one mile second-hand T rails of 25, 30 or 35 lbs. to the yard.

The Henderson Steel & Mfg. Co., of Birmingham, has increased the 1½-ton experimental furnace to 3½ tons capacity.

The Stewart Iron Co.'s mills, at Sharon, Pa., started up this week after eight months' idleness.

The firm of Hussey, Howe & Co., Limited, steel manufacturers, at Pittsburgh, has been changed to Howe, Brown & Co., Limited.

The Wheatland Rolling Mills, at Sharon, Pa., will be started next week, after 15 years' idleness on account of litigation.

The Catoctin iron furnaces, near Mechanicstown, Md., are now in full blast. They were purchased for $75,000 from the Catoctin Iron Co. by a syndicate, of which Thos. Gorsuch, of Frederick, is President.

Work on the new 100-ton furnace of the Gadsden (Ala.) Furnace Co. is nearing completion, and it will go into blast about Sept. 20.

The Composition Iron Co. has been formed at East St. Louis, Ill., with a capital of $500,000, to manufacture castings. Incorporators, Gustave Fry, F. H. Ellis and Gustavus Heidel.

A $100,000 stock company has been formed to build a rolling mill at Cartersville, Ga.

The Rail Market.

Steel Rails.—The market continues dull. Quotations at Eastern mills, $28.50@$29. The deliveries for this year to Aug. 1, have been 710,502 gross tons, as compared with 1,045,048 gross tons to the same date last year.

Old Rails.—Market strong and supply limited. Tees are held at $24, and double-heads at $25.

Spikes.—Market firmer, and offers being withdrawn. Quotations for small lots, $2.15. Angle bars firmer.

The Boylston Street Bridge, Boston.

The bridge which is to carry Boylston street over the Boston & Albany tracks in the Boston "back bay" district is in progress. The bridge crosses the tracks at an angle of about 26 degrees. Therefore, the trusses are 216 ft. long, although the width of the railroad road way is but 60 ft. On account of the great skew overhead lateral bracing between the trusses is impracticable, therefore each truss is double, being composed of two trusses placed about 6 ft. apart. In order that our readers may know what a Boston reporter can do when he gets loose on a bridge we reprint the following from one of the journals of that city:

"Each truss is double, so that measured laterally, and including the space between the two parts, the compound or double truss is 8 ft. wide from outside to outside. In one view of the matter each of these double trusses may be considered to be a bridge in itself, and in this view the actual bridge or traveled way may be considered as hung between and attached to the two mechanical, architectural, or, so to speak, theoretical bridges called trusses. But the ordinary observer looks at such a structure synthetically, and as one combined whole. Thus viewed, the structure is not only, as already remarked, one of dignity, but of beauty also. The long curve or arch, which the upper member of each truss is, combines happily with the diagonal lines of the cross braces and the iron or steel lattice work which is comprised in the interlocking and strengthening subordinate construction. The whole greets and satisfies the eye when seen from a point either near at hand or distant, and the most timorous or skeptical has assurance, when he observes the dimensions and the firmness of the several parts, that the bridge will carry safely all loads that will ever be put upon it."

The Electric Light on Vestibule Trains.

The Pullman Palace Car Co. have applied the electric light to one of the Pullman vestibule trains running on the Pennsylvania, between Jersey City and Chicago. The light will be applied to other trains shortly.

A. J. Stevens' Spark Arrester.

The latest engines built for the Southern Pacific are ten-wheelers. They are fitted with an extension front and a spark arrester, invented by the late A. J. Stevens, Master Mechanic of the company. This spark arrester is said to absolutely prevent the passage of sparks or cinders, reducing to a minimum the danger of fields of grain being set on fire by passing engines.

The Train Telegraph.

The Union Pacific is to make a trial of the Consolidated Railway Telegraph Co.'s train telegraph system, the Superintendent of Telegraph having examined its working on the Lehigh Valley.

Car Heating.

The Wagner Palace Car Co. has recently given an order to equip 80 Wagner cars with the Martin system.

Elevated Tracks for Allegheny City.

The Pennsylvania Company has submitted to the City Council of Allegheny a plan for the elevation of its tracks through that city. The proposed changes will cost $2,500,000 to $3,000,000, and include a new freight station. It is hoped that the work may be begun next spring.

New Shops for the Cooke Locomotive Works.

The Cooke Locomotive Company, Paterson, N. J., has given out contracts for the erection of extensive buildings in the section of the city known as Madison Park at the southern extremity. The present plant of the company will be removed there from Market street, near the Passaic Falls. The new works will be convenient to the Delaware, Lackawanna & Western and the Erie.

Fast Time on the Union Pacific.

The Union Pacific claims the distinction of having made the fastest long-distance run west of Chicago. Mr. G. B. Markle, a business man of Portland, Or., received a telegram from Chicago notifying him that his father was lying at the point of death, and bidding him to get there in as short a time as possible. Mr. Markle hired a special train and left Portland Tuesday, at 6 p. m. and arrived in Omaha, Neb., at 6.52 p. m. Thursday. The average rate of speed, including stops, between Portland and Omaha was 38.8 miles per hour. The total distance is 1,821 miles and allowing for the difference in time, the actual time occupied was 46 hours 52 minutes.

United States Rolling Stock Co.

At a recent meeting of the stockholders in London President Hegewisch said that the income account of the last six months showed the wisdom of confining the operations of the company mainly to construction work. During the six months the earnings from construction amounted to $104,000, mainly from one shop—that at Hegewisch. The Anniston shop was in work two months, and it contributed nearly $30,000 to that account. "By the end of November the Decatur works will be in operation. The Anniston shop now has a capacity of 12 and it is intended to be increased to 20 cars per day. With Anniston increased to its full capacity of 20 cars and Decatur with 15 cars per day the earnings are expected to reach $400,000 a year, equal to 10 per cent. on the present capital. If we had been in a position to take all the contracts offered to us I could have promised you 12 per cent. for the year."

Train Signaling Device.

Charles P. Larned and R. V. R Sill, of Detroit, have patented a means of signaling from one portion of a train to another with compressed air. The signal is made by liberating compressed air. It is said that the apparatus is so accurate that it can be used for sound telegraphy.

The Poughkeepsie Bridge Connected.

The Poughkeepsie *News-Press* says that at 6:40 P. M., Aug. 30, a cannon was fired from the top of the Poughkeepsie bridge and that "from the shores of Dutchess to the verdure-clad hillsides of Ulster there ran a thrill. The Hudson River had been spanned by one of the greatest engineering monuments of the age. The coal fields of Pennsylvania and the cities of New England had been brought within hand-grasp." The thrill and the other phenomena were caused by the joining of the last of the connecting trusses of the bridge. The same journal is authority for the statement that "every part fits with the nicety of a French glove on a patrician hand." Among those who were present on the bridge at the time were Chief Engineers J. F. O'Rourke, A. B. Paine, and P. P. Dickinson, representing the Union, Manhattan and Poughkeepsie bridge companies; Messrs. Macdonald and Hayes, of the Union Bridge Co; Mr. Geo. S. Morrison and Col. John McLeod. Mr. O'Rourke and Mr. Paine were the first to cross. In the evening Mr. O'Rourke gave a dinner to those who have helped him in the work. Covers were laid for 300 guests. Messrs. William and Robert Baird, who have erected the superstructure, were present, as well as several engineers not connected with the work. Apparently everybody had what is known as "a good time."

Rolling Stock for Sharp Curves.*

Colonel de Bange has proposed a new arrangement of wheels for facilitating running over sharp curves. The axles are fixed, and the wheels turn on axle journals of such a shape that, while resting on the wheels, through the interposition of a cushion, they admit of the wheels turning on a vertical axis which is in a line with the point of contact with the rail. The cushion is furnished with a cylindrical projection which, fitting into a recess in the flat base of the axle, serves as a pivot, enabling the cushion to follow the slight horizontal rotation of the wheel, while attached to the axle by two bands. By this arrangement the wheels always assumes a position tangential to the rail; and by combining this with a longitudinal play of the axles, a vehicle with any number of axles could run round a very sharp curve. This arrangement, moreover, enables the full amount of adhesion to be given to locomotives, combined with a long wheel-base, a great gain for engines designed to run on lines with sharp curves, which often have steep gradients as well. A method of coupling the wheels, whilst leaving them free to adapt themselves to the curves, has been adapted to a small 8-wheeled locomotive, weighing 10 tons, and tried in the workshops of the Cail Company, in Paris, the axles being arranged for running round curves of only 40 ft. radius. A rigid triangular connecting rod is attached to the driving shaft, and guided by two cranks, so that its motion is parallel to the frame; it carries a projecting bar opposite each wheel, inserted into a swivel table fastened to the wheel by a spring, so that the connecting rod guides the wheel in whatever position it may be.

A Rod for Cross-sectioning.

In some "Notes on Railroad Construction," read by Mr. Theodore Low, read before the Engineers' Club of Philadelphia, he gives the following description of a rod used by him in cross-section work:

"I devised a rod which I used to good advantage on some of my work on the Pennsylvania & Schuylkill Valley Railroad, at those places where the *distance* stakes had been accidentally destroyed by heavy blasting.

"Out of well-seasoned pine I had a rod constructed, which was 16 ft. in length, 1 in. in width and 2½ in. in depth. This rod was graduated into feet and tenths. A level tube was inserted about 4 ft. from one end, and a 'bucket handle' also attached between the bubble and shorter end of the rod, in order to give a good leverage when holding the rod while measuring.

"At the end farthest from the bubble a roller was inserted, the outer circumference of which was flush with the end of rod. A piece of tin was then put on encasing the end of the rod and the roller, this to act as a guide for the tape line.

"Standing on top of a rock slope you extend the rod, carefully leveling the same (having previously run the end of a 50 ft. metallic tape line between the casing and roller, and to the line attached a plumb-bob), you let the tape unwind slowly until it touches the grade beneath, then, noting what it reads at the end of the rod nearest to you, deduct the length of the rod and you have the perpendicular height or cut. Then, finding the point where the plumb-bob struck the grade, add to or subtract from the length of the rod, if the point is to in or out of centre line, thus getting at the same time the horizontal distance out in addition to the perpendicular height."

* Proceedings Inst. Civil Engineers vol. xci., 1888.

THE SCRAP HEAP.

More Fast Time.

We pulled out from Linck's Hotel promply at 5:25. At Maplewood the speed was so great that we came very near passing a pack peddler. It looked at one time as if the train would surely be the winner, but onward trudged the peddler with might and main, and it was evident that we were in for a close and exciting race. The chances were slightly in favor of the train winning the race, but just at this time Madison was sighted and the accommodation had to take the side track for a hand car and two freight trains. When we pulled out from Madison our watches showed that the 7 miles had been made in 57 minutes. We rushed madly along to Edgefield Junction, where we had to wait for the conductor to carry a lady and her bundles to the ferry. While there we saw the peddler, who had eaten his supper and was quietly smoking his cob pipe as we pulled in. The next place we stopped was at Shutesfield, where Charlie McCoy, of Sandersville, got off, went out by the way of Porter Grove's, bought 3 yearling calves, and was at Rockland waiting for us when we got there. We rushed wildly along from Rockland to Hendersonville, where we only stopped about 20 minutes, when we sped along to Drake's Creek, where we had to take the side track again in a cornfield to wait for the southward ound passenger train. We pulled into the depot at Gallatin promptly at 7:40, having made the distance of 26 miles in the remarkable time of 2 hours and 15 minutes.

Lubricants.

It is said that between Harrisburg and Steelton the potato bugs are so thick that "a down train on the Steelton branch of the Reading was stopped by the mashed bugs on the rail." The last time this item appeared it was toads that greased the rails.

Railroads for Siam.

The Siamese Government has granted a concession for building two railroad lines, one of which is to connect Bangkok with its port Paknam. It is stated that the government has undertaken the construction of a steam tramway in the capital.

Double-Turreted Monitors.

The double-turreted monitor "Terror" was rebuilt by the Messrs. Cramp, and will be formidable for harbor defense when completed, some three years hence, as her armor and armament are not yet commenced. The other three of this class of 3,815-ton monitors are the "Monadnock," the "Amphitrite" and the "Miantonomoh." The turrets of the last-named vessel progress but slowly, and only two of her 10-in. guns are completed. The armor for the "Miantonomoh" is of the compound type and was furnished from abroad; that for the others is to be of steel and will be of domestic manufacture, the first of such weight and thickness ever contracted for in the United States, the armor for the sides being 7 in. and for the turrets 11½ in. thick.

South African Railroad Extensions.

Both the Cape Colony and Natal are growing anxious about the traffic of the Orange Free State and more anxious about that of the Transvaal Republic. Natal, besides extending the line between Durban and Ladysmith towards Pretoria, is proposing to extend the line from Durban north 50 miles along the coast to Verulam, into and through the Zululand, over the Lobombo Mountains through Swaziland to the Barberton gold district of the Transvaal. As England has just assumed a protectorate over both Swaziland and Amatongaland, it is urged that the 400 or 450 miles of railroad proposed will more than pay for itself in the same way that the Transcaspian Railroad has paid Russia, besides the commercial advantages which will accrue to Natal

The Transvaal government wish to get the Delagoa Bay road fairly into their territory before it is tapped by roads from the British colonies, and offered the Cape Colony free trade if they would suspend extensions to the north until the Delagoa Bay road is 80 miles past the Portuguese boundary. But by the force of existing treaties free trade would also, it is urged, be extended to England and Portugal, which, it is asserted, would flood the gold mining country with wheat from Australia, and wines, etc., from Portugal, interfering with the wheat and spirit trades of the Cape Colony. In consequence of this plea a proposition to suspend the extension of the line from Capetown to Kimberly north through Bechuanaland indefinitely towards the Zambesi was defeated, and lately the Orange Free State has declined to allow the construction of a line from Colesburg through its territory to Johannesburg and Pretoria, deciding that it cannot go beyond Bloemfontein, the capital of the state, a town of about 4,000 inhabitants. Sir Gordon Sprigg, the Premier of the Cape Colony, has decided to throw all his resources into the extension of the Kimberly line through the Bechuana country into Matebele land, where "there are stores of gold said to be something beyond the belief and imagination of man," to use his words.

The extensions beyond Kimberly and Verulam extend into the regions outside of the control of the Cape Colony and Natal, so that it will be necessary to approach the home government for powers and financial assistance.

The Railroad Y. M. C. A.

The East Albany branch acknowledges pictures for the decoration of its rooms from the Central Pacific, the Chicago, Burlington & Quincy and the Michigan Central.

The Buffalo Railroad Young Men's Christian Association has just occupied new spacious and comfortably furnished rooms in Rumsey Block, corner Ellicott and Exchange streets.

Singular Object of an Invention.

A mechanic of Bridgeport, Conn., has invented a locomotive attachment which utilizes the phonograph to record the exact time at which every blast of the engine's whistle occurs. This will, it is claimed, be of great value to railroad companies in protecting them from false representations of persons who are injured or mutilated while on the track.

The inventor, in order to make the instrument of practical utility, should add two attachments, one showing distinctly that in every case the man broke his own leg or mashed his own spare ribs; and another recording accurately all the cuss words used by those whose rest is broken by prolonged howls of locomotive whistles.

Scientific Method of Obtaining an Average.

Many calculations recall very forcibly the account given by John Phœnix (Lieut. Derby) of his experience in making a survey for the government of the distance from San Diego to the Mission Dolores. The method adopted was triangulation; but not having a full set of the proper instruments he used a three-legged stool instead. The instrument indicated a distance slightly in excess of seven miles; but for the purpose of correcting possible errors due to the personal equation of the observer and possible defects in the instrument, Phœnix stepped into a grocery, and taking an observation at the barkeeper through a glass, asked him what the distance was: The answer was that it was "about three mile and a half." Averaging this reply with the measurements obtained after the methods prescribed by science, Phœnix found the "true mean distance" to be five miles, three furlongs, and two and a half yards, and so reported to the government.—*Detroit Free Press.*

Augusta Exposition.

The Georgia Railroad, which styles itself the "Stone Mountain Route," has issued at attractive folder showing the time of trains and through cars from all points to the Augusta National Exposition, which is to be held in Augusta, Ga., from Oct. 10 to Nov. 17. The exposition grounds cover 93 acres, and the circular states that excursion rates are to be given from all points. The circular also gives a succinct account of the advantages of the city of Augusta, and notices of various health resorts on the line of this road. Among the latter is the Electric Mound Hotel, at Hillman, Ga., on the Washington Branch, 112 miles from Atlanta. At this place there are electric rooms cut into the rocky side of the mountain, in which the medical treatment consists in the mere presence of the patient in the room. No artificial means are employed, the current of electricity coming from the rocks.

D. H.

In an emergency lecture to railroad men, a skeleton was used for illustration. Thus the dead head will maintain his hold on the railroad despite the Inter-state Commerce law.—*Boston Commercial Bulletin.*

Severe.

The car-builder who invented the new style of window that will only raise about 8 in., leaving the lower part of sash directly in line with the eyes, ought to be cremated in one of his own sweat-boxes. Companies that have cars varnished with a sprinkling pot, thus gluing the windows fast, should furnish crowbars to enable passengers to raise them. —*Locomotive Engineer.*

Cable Concession in Hawaii.

The Minister of the Interior has been authorized to enter into a contract with J. Sherman Bartholomew, residing in Honolulu, Hawaiian Islands, or with any other persons or corporation, for the construction and maintaining of a submarine telegraph cable or cables to connect the islands of the Hawaiian group from Hawaii to Kauai, as follows: From Hawaii to Maui, from Maui to Oahu, with a landing on Molokai, and from Oahu to Kauai, together with lines of land telegraph to connect the same with all or any points on the Hawaiian Islands. The contractors will have exclusive rights for submarine cables and connecting land lines for 10 years. It is provided that the cables shall be ready for use by July 1, 1889. The sum appropriated as a subsidy for the cable lines is $25,000.

By Rail to Asia.

This time the railroad up the Pacific Coast and across Behring's Strait is brought forward by an officer "of the United States army, a pioneer engineer and pathfinder who has already proved his claims to the character of a prophet in more than one notable instance." The able prophet has nothing new to suggest with regard to the road, but by the exercise of his gift he has got at accurate figures of its cost, viz., $62,500,000 to Behring's Straits, and $20,000,000 for a bridge across. The indiscreet reporter asked the prophet, "What would you do when you arrive in Siberia?" Here the quality of the inspiration petered out, so to speak, and the prophecy became less specific, and the reporter was asked, "What is a railroad train but an improved caravan?" That seems to have stopped his questions. The prophet did, however, intimate that the great white Czar would take care of that end of the line.

Strike of Brakemen.

All the freight brakemen on the St. Paul, Minneapolis & Manitoba in the St. Cloud yards refused to go out Sept. 4. It is said that they want three men to a train of 43 cars, and the company refuses to allow that number. The strikers were discharged.

Not a Vestibule Train.

The first train passed over the new Poughkeepsie railroad bridge last Friday evening. It was a lady's train, however, and was attached to the wife of one of the men associated with the erection of the bridge. She, in company with her husband, walked across from the east to the west shore, part of the way on the top of the fifteen-inch truss. It was a daring and dangerous undertaking, but then the venturesome lady has the distinction of being the first woman to cross the bridge.—*New York Sun.*

A Rear Collision in France.

An express train from Dijon to Paris was derailed the night of Sept. 4, blocking the road. The Italian night mail ran into the disabled train and was wrecked. According to the latest report nine persons were killed, thirteen severely injured, and many more slightly injured. Both engines went down an embankment and eight cars were smashed to pieces.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

The Supreme Court of the United States rules that the Virginia statute taxing the rolling stock of "every railroad company not exempted from taxation by virtue of its charter" is not applicable to the rolling stock of a foreign corporation which is used on its leased roads within the state owned by home corporations not exempt.[1]

In a case from Indiana the Supreme Court of the United States holds that where one railroad leases its line to another, which is owned and operated by a third, but the lease is adjudged void, and the lessee road issues bonds, of which the third road becomes the holder, and the bonds are foreclosed and the proceeds held for distribution, the lessor road is not entitled to be paid its rental out of the proceeds in precedence to the third road as a bondholder, on the ground that the third road, as the owner of the lessor road, is really the debtor for arrearages of rent; that current earnings of a road are first to be applied to operating expenses, and if diverted to pay mortgage bondholders can be recovered from them; that this right does not exist as against holders of second-mortgage bonds for earnings misapplied by payment of interest on first mortgage bonds, and that rent due for a leased line is not entitled to be paid out of the proceeds of a foreclosure sale, in preference to mortgage bonds, in the absence of a showing that the holders have been benefitted by the default in payment of rent.[2]

In a case from Kansas the Supreme Court rules that a court of equity at the suit of a judgment creditor of a railroad may compel it to assign its rights against a county which has subscribed to its stock, but cannot compel the county to issue its bonds to the creditor. This can only be done by *mandamus.*[3]

A New York statute (Laws 1868, cap. 84) authorizing the defendant company to build and operate a railroad, provided as a condition precedent that it should prove to a board of commissioners that a certain amount of the capital stock had been subscribed and paid in, and who should give a certificate to that effect. By subsequent amendments it was provided that the work might be begun when the board should have certified that the company had made suitable and reliable financial arrangements. But the company did not prove this to the board nor obtain their certificate. The Supreme Court hold that the company was not authorized to commence the construction of the road.[4]

In New York in a proceeding to foreclose a mortgage on a railroad, it appeared that the mortgage secured bonds for $1,500,000 having several years to run and above par on the market, and that the suit was brought by the holders of $79,000 of bonds for the purpose of reorganizing the company and compelling the bondholders to take their money or bonds bearing a lower rate of interest. The Supreme Court decides that the bondholders not desiring a foreclosure may be allowed to purchase the bonds of the others, pay costs, and stop proceedings.[5]

In a case from California the Supreme Court of the United States holds that a state cannot, without the permission of Congress, tax a franchise conferred by it as here a franchise conferred on a railroad to construct a railroad to the Pacific Ocean.[6]

In a case from Tennessee the Supreme Court rules that the grant of power to a municipality to subscribe for stock in a railroad company does not carry with it the implied power to issue bonds therefor.[7]

In a case from Illinois the same court decides that in an action by a railroad to recover for the use of its tracks by another road where there was no express agreement as to the sum to be paid for such use, the amount paid it by other roads is not the measure of damages.[8]

In a case from Kansas the same court holds that the statute of that state providing that railroads shall be liable to its employés for damages caused by fellow servants or employés is not unconstitutional,[9] and in a Minnesota case, the same decision is made in regard to a similar statute in Minnesota.[10]

In Iowa the Supreme Court holds that a street railroad company operating a track of a certain gauge for a number of years without objection, under an ordinance giving it the right to lay tracks without prescribing the gauge, cannot be required by the city to use a different gauge in laying down such additional track as it desires.[11]

In the same state the Supreme Court decides that a railroad applying for an injunction to prevent another railroad from crossing its track at a point which would require plaintiff's trains to stop on a descending or ascending grade, the increased cost to defendant to make an under crossing being less than $15,000, is entitled, under Code Iowa 1880, § 1,265, requiring a crossing to be so constructed as not unnecessarily to impede travel, to an injunction, although, after recommendation of the railroad commissioners that the crossing be of a character requiring a change in plaintiff's track, plaintiff has never offered to make the change and defendant without demanding it has incurred expense that will be fruitless if the injuntion is granted.[12]

In Michigan the Supreme Court decides that the state statute, authorizing an attorney's fee of $25 to be taxed against a railroad company in case of judgment against it in an action for injuries to stock on account of the failure of the company to fence its track, as required by the act, is unconstitutional and void, as being an attempt to grant special advantages to one class at the expense and to the detriment of another.[13]

In Massachusetts the Supreme Judicial Court holds that the statute requiring railroad corporations to give equal facilities to all persons and companies for the transportation of themselves, their agents and merchandise, does not require railroad corporations to discriminate in favor of express companies, and to carry their merchandise and messengers in the baggage cars of passenger trains on reasonable terms, equally favorable to all express companies.[14]

In a Vermont case the plaintiff was general attorney for the defendant railroad company, and in that capacity, but under specific directions from its president, he rendered services and was paid for the same. After he ceased, by a tacit understanding, to be such general attorney, and without ever having been employed as a special attorney, and without any knowledge on the part of the defendant's agents, except its attorney, who had no authority to employ him, he also rendered services of some value in the same suits. The Supreme Court hold that he cannot recover for these services.[15]

The Supreme Court of Texas holds that the statute of 1856, granting the Memphis, El Paso & Pacific Railroad Co. all vacant lands within eight miles of the extension line of its road, upon which the company invested its money, is a contract within the protection of the United States constitution, and is not affected by Const. Tex. 1869, art. 10, sec. 5, declaring said lands open to purchasers, settlers, locators and holders of genuine certificates, and that a designation of lands under that act is sufficient which describes the line of the road as extending from a given point, a certain course and distance, to another point, and affords all information necessary for the exact location of the line, though no actual survey was made, under section 15 of said act, which provides that all the vacant public land within eight miles of each side of the extension line of said road shall be exempt from location or entry from and after the time when such line shall be designated by survey, recognition or otherwise.[16]

A Missouri statute provides that no officer or employé of any railroad corporation shall be interested in furnishing supplies to such company, nor in the business of transportation, as a common carrier, of freight or passengers over the works owned, leased or operated by the company of which he is officer or employé. Plaintiff was stock agent of defendant, a railway corporation existing under the laws of Missouri, and operating a road in Texas; and while so employed he made a contract with defendant whereby he leased for a term of years certain of defendant's stock-yards in Texas, defendant to pay him $1 per car for loading and unloading stock, for which he was to furnish forage, to be charged against shippers and collected by him. The Supreme Court of Texas holds this contract void under the statute.[17]

Carriage of Goods and Injuries to Property.

In New York the Supreme Court rules that in an action for damages caused by fire escaping from a locomotive, it is competent to show negligence in the defendant railroad, to prove that other roads in the vicinity used better spark arresters.[18]

In New York a railroad company agreed to protect the land of an adjoining owner from overflow of water, and to construct a depot site on his land, if he would furnish the sand and gravel near by, but used the earth furnished in another place, and the embankment which it did make, being made of ashes and cinders, was unfit to turn the water. The company also failed to construct the depot site. The Supreme Court rules that the damages the adjoining owner can recover are the cost of constructing with sand and gravel the embankment and depot site as agreed.[19]

In New York a company was authorized by statute to construct a main line and several branches. It never constructed the main line. The Supreme Court hold that it has no power to construct the branches.[20]

In Vermont the Supreme Court holds that an action at law may be brought against the receiver of a railroad for negligence in constructing a crossing without leave from the Court appointing him; that where a railroad is authorized to cross highways, it is under a duty to construct its road across them in a reasonable manner, with reference to the double use of the crossing, for its own purpose and for travelers, and that the word "crossing," as used in the statute and applied to the intersection of a highway and a railroad, means the entire structure, including the approaches, although a part may be outside the limits of the railroad lands.[21]

A Kentucky statute gave to a city power to contract for the construction of street railroads. In the contract made with plaintiff, the council reserved the power to permit other companies, upon compensation, to use plaintiff's track. Defendant, under its charter authorizing it and the city council to contract "in such manner * * * and with such rights and privileges as the council may prescribe," contracted with the council to have the privilege of running over plaintiff's track "when the consent of said City Railway Company [plaintiff] shall be obtained." Contract was then entered into between the two companies regarding the use of the track; the terms to be readjusted when necessary, "upon an equitable consideration." Readjustment was determined upon the basis that defendant's right to use plaintiff's track was derived by its charter from the legislature, and that it was therefore liable only to pay for the use and wear of the track. The Court of Appeals holds this wrong, and that plaintiff's compensation should be determined by a consideration of the contract between them and of the growth of the business. The Court also holds that the contract between the city and the plaintiff did not take from the legislature the right to permit other companies to go upon the same streets or upon the plaintiff's track.[22]

In Texas, in an action against a railroad for an injury to the plaintiff's grass by fires alleged to have been set by sparks from defendant's engine, the evidence showed that defendant's road passed through plaintiff's land; that the fire occurred soon after the train passed; that dry grass and weeds were permitted to accumulate on defendant's right of way at and about the place where the fire occurred, and that at the time and before the fire it was not unusual for defendant's engines to throw sparks and coals of fire on its right of way. The trial court found that the fire occurred through the negligence of defendant. The Supreme Court affirms the judgment, and also holds that in addition to the value of the grass on the ground at the time the fire occurred, the plaintiff was entitled to damages resulting from injury to the grass roots, whereby the ground was rendered less productive.[23]

Injuries to Passengers, Employes and Strangers.

In New York an elevated railroad passenger in passing from one car to another stepped into the space between the cars, and was injured. This space was closed when the cars were standing still. The Supreme Court rules that the conductor was not negligent in not warning the passenger of the opening, and the company is not responsible.[24] In a similar case, the car being crowded, the passenger was forced to stand on the platform, and he was pushed by the crowd between the cars and killed. The Supreme Court holds the company responsible.[25]

In Missouri a railroad sold a return ticket to a point beyond its line, the contract stating that the railroad acted only as agent of the connecting carrier and was not responsible; that the ticket was not good to return on unless the passenger identified himself at the terminus and the agent of the connecting carrier stamped it; that the passenger would identify himself when called on and that no agent had authority to alter the terms of the contract. At the terminus on his return, the passenger found no agent there to stamp the ticket, and therefore, he proceeded on his journey, but on reaching the first line again he was ejected, because his ticket was not properly stamped. The Supreme Court of the United States holds that the railroad is not liable for the ejection, as it was not, under the contract, bound to accept the stamped ticket, and the failure of an agent to be present at the time at the terminus was not due to its neglect.[26]

In New York a man was walking on a track built over low marshy ground, on each side of which was a ditch filled with water. There was no way of getting off the track except by jumping into the ditch or across it. When the man first saw the locomotive it was over 900 ft. behind him, and he was about 150 feet from a platform where he could get off the track. The engineer knew the difficulty in getting off the track at that place, and could, by reversing his engine, have avoided running over the man. He did not and the man before he could reach the platform was struck and killed. The Supreme Court affirm a verdict against the railroad.[27]

In the same state the Supreme Court rules that while the law does not require sounding a whistle at a private crossing, yet if the railroad is in the uniform habit of so doing, a

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1 Mayle v. B. & O. R. Co., 8 Sup. Ct. Rep., 1,037.
2 St. L., A. & T. H. R. Co. v. C., C., C. & I. R. Co., 8 Sup. Ct. Rep., 1,011.
3 Smith v. Bourbon Co., 8 Sup. Ct. Rep. 1,043.
4 Astor v. N. Y. A. R. Co. 1 N. Y. Supp., 174.
5 Tillinghast v. Troy & B. R. Co., 1 N. Y. Supp., 243.
6 State v. Cent. Pac. R. Ct., 8 Supt. Ct. Rep., 1,073.
7 Norton v. Town, 8 Sup. Co. Rep., 1,111.
8 P. & P. U. R. Co. v. C. P. & S. W. R. Co., 8 Sup. Ct Rep., 1125.
9 Mo. Pac. R. Co. v Mackey, 8 Sup. Ct. Rep., 1,161.
10 Minn. & St L. R. Co. v. Herrick, 8 Sup Ct. Rep., 1,177.
11 Des Moines & R. Co. v. Des Moines & R. Co., 38 N. W. Rep., 496.
12 H. & S. R. Co. v. C., St P. & K. C. R. Co., 38 N. W. Rep., 413.
13 Schut v. C. & W. M. R. Co., 38 N. W. Rep., 291.
14 Bates v. Old Colony R. Co., 6 New Eng. Rep., 583.
15 Safford v Vt. & Canada R. Co., 6 N. Eng Rep., 510.
16 H. & T. C. R. Co. v. Tex. & Pac. R. Co., 8 S. W. Rep., 498.
17 Rue v. Mo. Pac. R. Co., 8 S W. Rep., 533.
18 Carley v. N. Y., O. & W. R. Co., 1 N. Y. Supp., 63.
19 Morrell v. Long Island R. Co., 1 N. Y. Supp., 65.
20 Goelet v. Met. Trans. Co., 1 N. Y Supp., 74.
21 Roxbury v. Vt. Cent. R. Co., 6 New Eng. Rep., 535.
22 Louisville City R. Co v. Cent. Pass. R. Co., 8 S. W. Rep., 329.
23 Mo. Pac. R. Co v. Ayers 8 S W. Rep., 538.
24 Clune v. Brooklyn E. R. Co., 1 N. Y. Supp., 239.
25 Merwin v. Manhattan R. Co., 1 N. Y. Supp., 367.
26 Mosher v. St. L., I., M. & S. R. Co., 8 Sup. Ct. Rep., 1,325.
27 Remer v. Long Island R. C., 1 N. Y. Supp., 124.

failure to do so in a particular case may amount to negligence.[28]

In New York one driving a wagon stopped at a sign board, 47 ft. from the crossing, but heard no sound of an approaching train, a strong wind blowing at the time. As he started, some children shouted to him in warning, but thinking that they were simply playing, he went on until he passed a building 9 ft. from the track, where for the first time he obtained an unobstructed view. His horses, though, were already on the track and were killed and himself injured. The Supreme Court affirm a verdict against the railroad.[29]

The Supreme Court of the United States in a case from Massachusetts follows the rule of that state that one traveling on Sunday not from "necessity or charity," cannot recover for injuries received on that day while so traveling.[30]

[28] Nash v. N. Y. C. & H. R. R. Co., 1 N. Y. Supp., 269.
[29] Brown v. Rome, W. & O. R. Co., 1 N. Y. Supp., 286.
[30] Bucher v. Cheshire R. Co., 8 Sup., Ct. Rep. 974.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Atlanta & Charlotte, 2½ per cent., payable Sept. 6.

Connecticut River, quarterly, two per cent., payable Oct. 1.

Delaware & Hudson Canal Co., quarterly, 1½ per cent., payable Sept. 15.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

East Tennessee, Virginia & Georgia, special meeting, Knoxville, Tenn., Oct. 18

Ithaca, Auburn & Western, annual meeting, 111 William street, New York City, Oct. 1.

Minneapolis & St. Louis, annual meeting, Minneapolis, Minn., Oct. 3.

Nashville, Chattanooga & St. Louis, annual meeting, Nashville, Tenn., Sept. 12.

Northern Pacific, annual meeting, Mills Building, New York City, Sept. 20.

Ohio & Mississippi, annual meeting, Union Depot, Cincinnati, O., Oct. 11.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Roadmasters' Association of America* will hold its sixth annual convention at the Metropolitan Hotel, in Washington, D. C., commencing at 9 a. m., Tuesday, Sept. 11, and continuing in session three days.

The *National Association of General Passenger and Ticket Agents* will hold its fall meeting at the United States Hotel, in Saratoga, N. Y., Sept. 18.

The American Society of Mechanical Engineers will hold its eighteenth convention and ninth annual meeting in Scranton, Pa., beginning Monday evening, Oct. 15.

The *Association of North American Railroad Superintendents* will hold its next meeting at the Southern Hotel, St. Louis, beginning Sept. 19.

The *Master Car and Locomotive Painters' Association* will hold its nineteenth annual convention at the Hollenden Hotel, in Cleveland, O., commencing Sept. 12, at 10 o'clock a. m.

The *American Institute of Mining Engineers* will hold its fifty-second meeting at Buffalo, N. Y., beginning on Tuesday evening, Oct. 2, 1888.

The *American Association of Railway Chemists* will hold its next meeting in Baltimore, Md., in October.

The *New England Railroad Club* meets at its rooms in the Boston & Albany passenger station, Boston, on the second Wednesday of each month.

The *New York Railroad Club* meets at its rooms, 113 Liberty street, New York City, on the third Thursday of each month.

The *Western Railway Club* will hold its next meeting on the third Wednesday in September, at the Grand Pacific Hotel in Chicago.

The *Central Railway Club* meets at the Tifft House, Buffalo, the fourth Wednesday of January, March, May, August and October.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its next regular meetings at its rooms in the Boston & Albany station, Boston, at 7:30 p. m. on the third Wednesday of September.

The *Western Society of Engineers* holds its regular meetings at its hall, No. 15 Washington street, Chicago, at 7:30 p. m., on the first Tuesday of each month.

The *Engineers' Club of Philadelphia* will hold its next meeting at the house of the Club, 1,122 Gerard street, Philadelphia, Oct. 6.

The Engineers' Society of Western Pennsylvania will hold its next meeting at Pittsburgh, Sept. 18.

The Engineers' Club of Kansas City will hold its next regular meeting Sept. 3.

Switchmen's Mutual Aid Association of North America.

This association will meet in St. Louis Sept. 17 and following days. It is said that efforts will then be made to work up a sentiment in favor of a coalition between this and other associations of railroad men, as was proposed a few weeks ago in connection with the troubles on the Burlington road.

PERSONAL.

—Mr. A. G. McComb, C. E., has resigned his position as Roadmaster of the Colorado Division of the Union Pacific to engage in the practice of civil engineering.

—G. A. Rose, Roadmaster of the Chicago, Burlington & Quincy, was killed in a collision between a freight and a construction train on that road near Krum, Ia., Aug. 27.

—Mr. F. W. Richardson, who has been General Eastern Agent of the Commercial Express Fast Freight Line for nine years, has resigned to engage in mercantile business at Troy, N. Y. He will be succeeded by J. D. Abrams.

—Sir David Radcliffe, Director, and W. Tunstill, Chairman, of the Lancashire & Yorkshire Railway, of England, are in this country for a brief inspection of American railroad methods. They are in New York City this week, and will go west.

—Thomas M. Everett died at his home near Illiopolis, Ind., Aug. 28, at the age of 71 years. He was fireman on the first locomotive that entered the city of Springfield, Ill., in 1842. George Gregory, engineer of the same engine, is still living at the age of 80. Mr. Everett was one of the oldest engineers in the state

—Colonel George L. Perkins, of Norwich, Conn., died on Sept. 5, at the Fort Griswold House, Eastern Point, near New London, Conn., aged 100 years and one month. The recent celebration of Col. Perkins' 100th birthday and of his completion of 50 years' service as Treasurer of the Norwich & Worcester Railroad, will be fresh in the minds of our readers (*Railroad Gazette*, Aug. 3 and 10). Col. Perkins had been ill only a week, and the cause of his death is given as old age. It is said that he had for twenty-five years looked forward with peculiar interest to the celebration which he enjoyed a month ago, and the consummation of his wishes seems to have rounded out his life.

—Mr. W. H. Fisher, Vice-President and General Superintendent of the St. Paul & Duluth, has resigned, to take effect Sept. 10, and will accept a position with another road. E. F. Dodge, General Freight and Ticket Agent, and P. A. Rockwell, Assistant General Freight and Ticket Agent of the same road have also resigned. Mr. Dodge will be succeeded by E. L. Dudley, at present Receiver for the Central Iowa.

Mr. Fisher has been President and General Superintendent of the St. Paul & Duluth from June, 1884, to the date of the election of R. S. Hayes in July.

Mr. E. F. Dodge has held the position he has just resigned for six years. Previous to his connection with the St. Paul & Duluth, he had been northwestern agent for the Commercial Fast Freight Line.

Mr. E. L. Dudley, who succeeds him, has been connected with the Central Iowa for five years, serving as Superintendent, then as General Manager, and, since December, 1886, also as Receiver. He was Superintendent of the Texas & Pacific from June, 1882 to July, 1883. Previous to this he had held the Superintendency and other offices on the St. Louis, Iron Mountain & Southern. He is 43 years old.

ELECTIONS AND APPOINTMENTS.

Atlanta & Florida.—T. O. Troy has been appointed General Superintendent, with office at Atlanta, Ga.

Beatrice, Nebraska City & Northwestern.—The following are the incorporators of this Nebraska company, mentioned last week: D. P. Rolfe, Robert Lorton and W. A. Cotton, of Nebraska City. The capital stock is placed at $2,000,000.

Brazos, Caney & West Texas.—The incorporators of this Texas road are: B. T. Masterson, of Galveston; E. Davis, J. H. Shepard, L. L. Smith, N. S. Brooks, of Columbia; J. K. White, of Caney; N. B. Wardsworth, of Matagorda; Harris Masterson and J. G. Smith, of Brazoria.

Canada Atlantic.—F. E. Dewey has been appointed General Baggage Agent, with headquarters at Ottawa, Ont.

Chattanooga, Rome & Columbus.—Col. J. R. Shaler, late General Superintendent of the New York, Pennsylvania & Ohio, has been appointed Traffic Manager of this road.

Chicago & Alton.—H. V. Miller has been appointed Superintendent of Telegraph in place of W. K. Morley, appointed Division Superintendent.

Denver, Texas & Gulf.—W. S. Kemp has been appointed Trainmaster of the fifth and sixth districts of the Pan-handle Route, composed of the above road, the Denver, Texas & Fort Worth and the Fort Worth & Denver City roads.

Eastern, Barnwell & Western.—W. H. Duncan has been elected President of this South Carolina road.

Florence Northern.—The following are the incorporators of this new Alabama company: W. B. Wood, J. H. Field, E. B. Cornly, Florence, Ala.; W. W. Bayliss, W. E. Blair, J. C. Connor, H. C. Wood, Montgomery, Ala.

Fort Worth & Denver City.—John Howard has been appointed Traveling Passenger Agent, with headquarters at Indianapolis, Ind.

Fremont, Elkhorn & Missouri Valley.—F. M. Marsh has been appointed Superintendent of Bridges and Buildings, with headquarters at Omaha, Neb.

Great Western Dispatch.—N. S. Skinner, Jr., has been appointed General Agent at Chicago.

Hawkinsville, Americus & Eastern.—Officers have been elected as follows: President, J. D. Stetson; Vice-President, R. J. Taylor; Secretary and Treasurer, R. G. Lewis. The general office is at Hawkinsville, Ga.

Lawrence, Atchison & Southern.—The following are the officers of the company: J. D. Bowersock, President; W. A. Morton, 1st Vice-President; S. W. Sawyer, 2d Vice-President; George Leis, Secretary; Edwin Brown, Treasurer; George H. Clark, Superintendent Land Department; T. J. Sternbergh, Chief Engineer.

Lexington Terminal.—The officers of this new Georgia company are: Hamilton McWhorter, president; W. A. Shackelford, vice-president; directors, Col. William H. Sims, Judge Samuel Lumpkin, William M. Howard, Joseph J. Smith, R. J. Willingham, W. Stewart and W. A. Dozier. T. G. Lester is Secretary and George C. Smith Treasurer. Office, Lexington, Ga.

Louisville & Nashville.—J. G. Metcalfe has been appointed Superintendent of the South & North Alabama and of the Birmingham Mineral road, vice Donald Allen, who is appointed Superintendent of the Henderson and St. Louis divisions of the Louisville & Nashville.

Louisville, St. Louis & Texas.—At a meeting of the directors held in Louisville Sept. 3, Maj. M. V. McCracken, of New York, was elected President, in place of Col. J. C. Fawcett, resigned. Maj. McCracken will also be General Manager of the new road.

Maysville & Big Sandy.—Capt. George Collier, of Lexington, Ky., has been appointed Roadmaster.

Memphis & Atlantic.—At a meeting of the stockholders in Columbus, Miss., Aug. 27, the following directors and officers of the company, which is a reorganization of the Memphis, Oxford & Columbus, were elected directors: Napoleon Hill, W. J. Crawford, R. C. Beckett, A. M. Abbott, J. A. Orr, A. C. Hargrove and Wm. G. Cochran. Officers: F. M. Abbott, President; Bell Price, Secretary and Treasurer, and J. A. Orr, General Solicitor.

Natchez, Jackson & Columbus.—J. B. Temans has been appointed Master Mechanic.

New York, Pennsylvania & Ohio.—J. C. Moorehead has been appointed Superintendent of the Western Division, with headquarters at Galion, Ohio, vice S. F. Randall, resigned.

North Attleboro & Wrentham.—The following directors were elected at a meeting of the projectors: J. D. Lincoln, D. H. Corey, H. E. Thompson, of Plainville, Mass.; D. Brown, H. A. Cowell, A. F. Bennett, of Wrentham; T. I. Smith, C. T. Guild, A. E. Codding, E. I. Richards and F. M. Whiting, of North Attleboro, Mass.

Northern Pacific.—Division Superintendent Robert Law has been made Assistant General Manager and placed in charge of the newly organized middle grand division of the road, extending from Billings to Missoula, and including all diverging lines between those points.

Oregon & Washington Territory.—John V. Creighton has been appointed Traffic Manager, with office at Portland, Or.

Port Jervis, Monticello & New York.—At the annual meeting at Port Jervis, N. Y., Sept. 4, the following were chosen officers and directors for the ensuing year: Peter E. Farnum, President; Wade Buckley, Vice-President; O. P. Howell, Treasurer; Charles Clark, Secretary, all of Port Jervis; directors, Solomon Van Etten, W. H. Nearpass, Francis Marvin, C. E. Cuddeback, Port Jervis; Henry R. Low, Middletown; C. V. R. Luddington, Thornton M. Niven, Monticello; Grandison Bennett, Wurtsborough, and the above named officers.

St. Joseph & Grand Island.—W. P. Robinson, Jr., has been appointed General Freight and Passenger Agent, with office at St. Joseph, Mo.

St. Louis & San Francisco.—W. R. Michie has been appointed Assistant Engineer. Headquarters at Arthur City, Tex.

Savannah, Florida & Western.—H. E. Hutchens has been appointed Assistant Master of Transportation.

Savannah & Western.—E. P. Alexander is President and E. Workman Secretary and Treasurer of this new organization of the Central of Georgia's controlled lines.

South Bound.—The following officers have been elected: President, John H. Hammond, of Savannah, Ga.; Secretary and Treasurer, W. S. Tison, of Savannah, and Thomas B. Lee, of Columbia, S. C.

Tennessee Coal, Iron & Railroad Co.—W. H. Griswold has been appointed Superintendent of Track; office at Pratt Mines, Ala.

Tennessee Midland.—E. D. Anderson has been appointed Master Mechanic.

OLD AND NEW ROADS.

New Companies Organized. — Atlantic, Gulf & Havana.—Brazos, Caney & West Texas.—Florence Northern.—Lexington Terminal.—Savannah & Western.

Alabama Great Southern.—The shops in Chattanooga, Tenn., have been shut up, and 100 men have been sent to Birmingham.

Atlanta & Florida.—The survey was commenced last week for the proposed southern extension from the present terminus at Fort Valley, Ga. The party is in charge of Chief Engineer H. L. Collier.

Atlantic Coast Line.—A survey is being made in Chesterfield, Va., opposite Richmond, for a line by which through trains can be run to and from the Richmond, Fredericksburg & Potomac without passing through the streets of Richmond. The connecting track through the city is on a very steep grade, and the city threatens to prohibit the use of locomotives upon it.

Atlantic, Gulf & Havana.—The company has been incorporated in Florida to build a road from St. Augustine via De Land to Tampa.

Baltimore & Ohio.—It is announced that an agreement has been arrived at with the Philadelphia & Reading for the formation of a through line for this road to New York City and Staten Island. No details are given out.

Brazos, Caney & West Texas.—Charter filed in Texas to build a road from Brazoria in a west and northwesterly direction across Brazoria County, and through a portion of Matagorda County to a point on Matagorda Bay, a distance of 25 miles. The capital stock is $25,000.

Central of Georgia.—A circular has been issued announcing the consolidation of the Montgomery & Eufaula, the Eufaula & Clayton, the East Alabama, the Columbus & Western, the Mobile & Girard, and the Southwestern railroads, into one company, to be called the Savannah & Western. Gen. E. P. Alexander, President of the Central of Georgia, is President of the new company, and E. Workman is Secretary and Treasurer. All the roads are controlled by the Central.

Chattanooga, Rome & Columbus.—In an interview published in the Atlanta *Constitution*, President J. D. Williamson states that work will probably begin in about two months on an extension of the road from Carrolton to Atlanta. The road is also to be built to Columbus, Ga., and if desired connections are not effected at that point it will be continued south into Florida.

Chicago, Kansas & Nebraska.—On the extension from Norton, Kan., to Colorado Springs, a distance of about 270 miles, track is now being laid at the rate of 2¼ miles per day, and is now completed to a point near River Bend, Col. It is expected to have the line completed to Colorado Springs by Oct. 10, and opened for traffic early in November. Some time ago arrangements were concluded with the Union Pacific, by which the tracks of that road will be used from River Bend to Denver, the Union Pacific having the right to use the Chicago, Kansas & Nebraska road from Colby, Kan., to River Bend, giving them a much shorter line between these points than they have at present. The company will also use the Denver & Rio Grande from Colorado Springs south to Pueblo and north to Denver. The extension is at present in operation from Norton to Goodland, Sherman County, Kan., a point near the Colorado state line and 106 miles from Norton. The grading has been practically finished the entire distance to Colorado Springs. Bethune, Craney Bros. & Co., of St. Joseph, Mo., are the principal contractors.

The contract for grading the coal branch, eight miles east of Colorado Springs, has been awarded and work will begin upon it immediately. The branch will be two miles long and will connect with the Denver, Texas & Fort Worth at Manitou Junction. The contractors are Carlile, Price & McGavock and J. B. Callahan & Co.

This road is now in operation to Pond Creek in the Indian Territory, about 25 miles from Caldwell, Kan. For the right to build through the territory the company pays the Indians a tax, which is to be imposed until the territory is opened for settlement.

Chicago, St. Paul & Kansas City.—This road has sold all its sleeping and parlor cars to the Mann Boudoir Car Co., which will hereafter operate this service on the road.

Chicago & Western.—This company has filed with the Secretary of State of Illinois, a certificate of dissolution and surrender of charter, stating that it has sold its property of every kind and that it owes no debts.

Chowan & Southern.—The contract for the building of the road from Drivers, Va., to Tunis, N. C., 36 miles, and also from the Roanoke River to Tarborough, N. C., 27 miles (completing the line from Norfolk to Tarborough), has been signed, and work will be begun at once. Ten thousand men and 500 teams have been employed and the road is to be finished by April 1, 1889.

Cincinnati, Washington & Baltimore.—Baltimore reports state that the company has confessed judgment in favor of the Baltimore & Ohio for $1,800,000 for advances made, and that this action was approved by the London committee of the company's bondholders.

Cincinnati, Wabash & Michigan.—The option on the stock of President J. H. Wade, held by Henry I. Ives, expired last week. Last year Ives agreed to purchase the stock at 86 cents on the dollar, and deposited $410,000. The time for the payment of the remainder has been several times extended.

Cleveland & Canton.—The company is constructing a three-mile branch from South Solon, O., to Solon, on the New York, Pennsylvania & Ohio. At Solon the branch will also connect with the Chagrin Falls & Solon road, which will at once be widened to standard gauge. The latter is now controlled by the Cleveland & Canton. It is expected to have the connection between the roads completed and the gauge of both roads widened by Nov. 1.

Columbia & Northwestern.—Incorporated in Dakota to build a railroad from Columbia via Newark and Forman to Milnor.

Concho Valley.—The company has been organized at San Angelo, Tex., with a capital stock of $25,000, by F. B. Malone, of Dallas, Tex., and others.

Dayton & Faunsdale.—Proposals are asked for building this road from Dayton to Faunsdale, Ala., eight miles. R. W. Price, of Dayton, is President.

Duluth, South Shore & Atlantic.—The first through train over the entire road was run last week from Sault Ste. Marie, Mich., to Iron River, Mich., and thence over the Northern Pacific to Duluth. A number of the officers and directors were aboard the train. The extension from Iron River to West Superior and Duluth, Minn., has been suspended, arrangements having been concluded with the Northern Pacific for the joint use by both roads of the Northern Pacific track between those points. The Duluth, South Shore & Atlantic is to pay to the Northern Pacific a rental of six per cent. of half the valuation of the road, as determined by three arbitrators. Henry & Balch, of Minneapolis, who had commenced work on the extension at Iron River, have transferred their forces to the Gogebic mining region in Northern Michigan, and have commenced work on the branches to Ironwood, Hurley and other towns in that region, mentioned in these columns some time ago. A survey is now being made for a proposed line between Houghton and Calumet.

Durham & Northern.—The track has now been completed from Durham northeast to Henderson, N. C., a distance of 40 miles, and the first train over the road entered Durham Aug. 29. The contractors were P. Lineham & Co. and E. Percival, Jr., and Bros. Wm. Monam is Chief Engineer.

East Tennessee, Virginia & Georgia.—It is said that this company is making surveys for a branch from the main line to Cedartown, Ga., about 10 miles. It is proposed to have it leave the main line at either Prior's or Cave Spring.

Ensley City Dummy Line.—This road, which was opened last October, extends from Birmingham, Ala., to Ensley City, 8 miles. The capital stock is $500,000, and there are $225,000 7 per cent. 20 year bonds. The road has been successfully managed by Maj. J. B. McClary, who is one of the youngest superintendents in the South. He has added $5,000 worth of rolling stock, besides paying interest on the bonds since beginning operations. There have been no accidents on the road, and it is said to be very popular with the traveling public.

Florence Northern.—Incorporated in Alabama to build a line from Florence, Ala., north to the Tennessee line and connect with a road to the coal fields of Wayne County, Tenn.

Fremont, Elkhorn & Missouri Valley.—The extension from Creighton northwesterly about 13 miles to Verdigris has been completed.

Georgia, Carolina & Northern.—The road is now in operation from Monroe, N. C., to Ashland, S. C., a distance of 32 miles.

Helena, Tupelo & Decatur.—The survey for the road was begun last week at Glendale, Miss., opposite Helena, Ark., and the line will be pushed through to Decatur, Ala. A. K. Robinson is Chief Engineer. The other members of the party are: J. C. Edwards, F. Witherspoon, E. C. Finley and T. M. Jacks.

Housatonic.—The extension from Botsford to Huntington, Conn., where connection is made with the extension of the New Haven & Derby, has been completed, making a line from New Haven to the Housatonic road about 22 miles long. The first train went over the line Aug. 30. By the use of the Housatonic main line between Botsford and Hawleyville, Conn., the New York & New England, which controls all the roads named, has a pretty direct line from New Haven to the Hudson River.

Ilwaco & Shoalwater Bay.—The road is now in operation from Ilwaco to Tinkerville, Wash. Ter., and tracklaying will soon begin on an extension north to deep water, near Oysterville. The grading is completed to within a few miles of Oysterville.

Jacksonville Southeastern.—This road has been sold to a company styled the Louisville & St. Louis. Of the suits instituted against the road by property owners in Centralia and vicinity last winter seven have been decided against the road. The damages awarded aggregate $20,000.

Johnsonburg.—The contract for the construction of this road, which is an extension of the Buffalo, Rochester & Pittsburgh in Elk and McKean counties, Pa., has been let to D. L. Miller and B. E. Wellendorf, of Lock Haven, Pa.

Kansas City, Memphis & Birmingham.—The company is building a branch to the Mineral road at Ensley Furnace, Ala.

Kentucky & Tennessee.—This company, chartered by the last Legislature, proposes to build a road from the Tennessee line through Hopkinsville, Christian County, Ky., northward to the Chesapeake & Ohio Railroad, and thence to the Ohio River. Christian County will be asked to vote $250,000 aid to the road this Fall.

Lake Erie, Essex & Detroit River.—The road is being constructed from Walkerville via Harrow to Leamington, in Western Ontario, and track is being laid at the rate of about a mile a day. John McAfee, Harrow, Ont., is Chief Engineer.

Lake Shore & Michigan Southern.—A new fast mail train between New York and Chicago has been put on and will leave Chicago at 8 a. m., reach Cleveland about 6 p. m., and arrive at New York at noon the next day. It corresponds to the west-bound fast mail. The Pennsylvania special of the Panhandle line now leaves Chicago at 10.30 a. m., arriving in New York the next afternoon at 4.

Lawrence, Atchison & Southern.—The contracts are now being let for constructing this road, and grading will commence within a week. The road is to be built from Atchison south through Winchester and Lawrence, and thence southwest to Carbon Hill and Burlingame, Kan. The company has leased what was formerly the Carbon Hill branch of the Union Pacific, which extends from Lawrence to Carbon Hill, Kan., 31 miles. The surveys have now been nearly completed for the balance of the line between Lawrence and Burlingame. W. A. Norton, Lawrence, Kan., is First Vice-President.

Lexington Terminal.—This is the name of the company which has been organized at Lexington, Ga., to build a road from that town to a connection with the Georgia Railroad, about 4 miles. A committee is at work raising funds, and the preliminary survey is in progress.

Manitoba & Northern Pacific.—The last rail on the Red River Valley road, now known by the above name, was laid at Winnipeg, Sept. 3.

The contract made by Premier Greenway with the Northern Pacific for the operation of this road by that company, was ratified by the Manitoba Legislature on Aug. 31, by a vote of 27 to 10. The agreement provides that the government is to complete the road from Pembina to Winnipeg, with a branch to Portage La Prairie, before Nov. 1, and transfer it to the Northern Pacific at cost value. The Northern Pacific is also within a year to build a line from Morris on the Red River Valley road to Brandon. The extensions will be built by a company to be incorporated under the title of Manitoba & Northern Pacific. The contract has been sent to the Northern Pacific directors for final action, as it is a modification of that negotiated in New York last winter by Premier Greenway. On behalf of the St. Paul, Minneapolis & Manitoba, Vice-President W. P. Clough of that road offered to lease the Red River Valley line at an annual rental, and guaranteed the use of the line to such roads, including the Northern Pacific, as desired to enter the Province, they to pay a pro rata share of the rental and of the expenses of operating. The offer was, however, not accepted. It is said that low maximum rates are guaranteed to Duluth.

Maryland Central.—This road, extending from Baltimore, Md., to Delta, Pa., a distance of 44 miles, which has been in the hands of receivers since October, 1884, is to be sold under foreclosure at Baltimore Dec. 10. A reorganization committee has reported a plan for a new company.

Mineral Range.—In the United States Court at Grand Rapids, Mich., Judge Severins last week rendered a decision granting an injunction to restrain Henry S. Ives, George H. Stayner and others from voting their stock in the road at the annual meeting of the company to be held this week. It was claimed that Ives, when he had control of the road, heavily watered the stock, and issued stock certificates without the proper authority and converted the proceeds to his own use.

Midland (Indiana).—The Scranton Co. and the Island Coal Co. have petitioned for the appointment of a Receiver, and H. Moore, General Superintendent, has been appointed. The road extends from Anderson, Ind., to Lebanon, 45 miles.

Nashville & Knoxville.—Ten miles of the section from Gordonsville to Cookeville, Tenn., are now about completed. Construction is in progress from both places.

New Albany & Eastern.—This road, extending from New Albany, Ind., to Watson, connecting the Ohio & Mississippi with the Kentucky & Indiana bridge, has been sold to the Ohio & Mississippi, the latter company assuming the mortgage on the New Albany & Eastern.

New Castle & Shenango Valley.—Tracklaying on this branch of the New York, Pennsylvania & Ohio has been completed. The road extends from New Castle to West Middlesex, Pa., 16 miles.

New Roads.—A company has been organized at Greenville, Tenn., to build a road from Paint Rock, on the line between Tennessee and North Carolina, to Big Stone Gap, Ky., about 90 miles. A. S. Johnson is one of the projectors.

New York & Rockaway.—This short Long Island road, which has been controlled by the Long Island Railroad Co., has now been consolidated with the latter, and will be operated as a division of it. W. E. Burroughs is Division Superintendent.

North Attleboro & Wrentham.—A charter will soon be applied for to build a road from a point on the New York & New England at or near West Walpole, Mass., then via Wrentham, Plainville and North Attleboro to the New York & New England again at Adamsville. Such a road would give a line between Boston and Providence about two miles shorter than the present New York & New England line. A committee of parties interested has been appointed to solicit subscriptions to the stock of the company, a preliminary survey of the line has been made, and as soon as $166,000 is pledged the right of way will be secured and construction work will be commenced. The New York & New England has agreed to lease the road if it is built, and it is said that the Old Colony has also offered to operate the road.

Northwest & Florida.—The stockholders of this road, at a meeting in Montgomery last week, voted to issue $180,000 first mortgage 50-year bonds and $900,000 income bonds. The mortgage is at 5 per cent. and the income bonds 4. The whole debt of the road when completed to the fifty-first mile post will be $612,000 first mortgage bonds, $306,000 income bonds and $612,000 stock. It is expected that the road will be in operation to the fifty-first mile post by Oct. 1. This is a reorganization of the old Montgomery & Florida.

Ohio, Indiana & Western.—The company has filed for record in Illinois a copy of a mortgage made to secure $2,000,000 second mortgage bonds.

Philadelphia & Chester Valley.—The reorganized company has filed for record a mortgage for $500,000 to secure an issue of 50-year bonds, which will greatly reduce the fixed charges of the road. The road is controlled by the Philadelphia & Reading.

Port Jervis, Monticello & New York.—The extension from Huguenot to Summitville, N. Y., 18 miles, has now been graded ready for tracklaying. At Summitville connection is made with the New York, Ontario & Western.

Portland & Ogdensburg.—The Supreme Court of Maine has issued a final decree discharging the Receiver, and the road passed into the possession of the Maine Central, under the lease, on Sept. 1, the authority of the general officers of the latter being extended over the leased line. Jonas Hamilton is Division Superintendent in charge of the leased road, which extends from Portland, Me., to Fabyans, N. H.

Rochester, Hornellsville & Lackawanna.—The creditors of the Central Construction Company, which operates the road, have attached the receipts and property of the line, and it is now in the hands of the sheriff. The last train on the road was run Sept. 3 to Hornellsville, when the property was seized. Several months' back pay is due the employés. The road extends from Hornellsville, N. Y., northward ten miles to a connection with the Lackawanna & Pittsburgh and has been running since last January.

Rockaway Valley.—The road is now open for freight traffic from the White House on the Central of New Jersey, to New Germantown, N. J., four miles.

St. Louis & Chicago.—The company has filed a certificate stating that the stockholders have refused to ratify the issuance of one thousand bonds of $1,000 each, jointly with the Mount Olive Consolidated Coal & Coke Co., date of May 1, 1888, maturing May 1, 1928, and the execution of mortgage of date of June 13, 1888.

St. Paul, Minneapolis & Manitoba.—Tracklaying on the Eastern of Minnesota has now been completed with the exception of about 12 miles. It is expected to have the entire line from Hinckley to West Superior, Minn., 70 miles, opened for traffic this month. Half the line has already been ballasted, the western end being nearer completion on account of the heavy bridging in the eastern part of the road. The steepest grade on the line is 21 ft. per mile, and the greatest curvature three degrees. The track is laid with 75 lb. rails. Extensive terminals have been provided at West Superior, 250 acres of land having been purchased. The company has the great northern elevator, with a capacity of 1,800,000 bushels, and is building another with a capacity of 1,500,000 bushels.

On the Duluth, Wilmar & Sioux Falls line the track has now been laid for a distance of nearly 75 miles from Wilmar, Minn., and will soon reach Sioux, Dak., 75 miles further. On the line from Cando to St Johns, Dak., 56 miles, tracklaying has been finished for 25 miles.

Selma & Cahaba Valey.—At a meeting of the stockholders in Selma, Ala., Aug. 30, it was unanimously resolved to authorize the issue of $3,000,000 of bonds. Active work will, it is announced, be commenced on the road immediately. The line will extend from Selma to Bessemer, through some of the best mineral fields in the state.

South Bound.—The preliminary survey for the road has now been completed, and a locating survey will probably soon be commenced. It is proposed to build the road from Savannah, Ga., to Columbia, S. C., in a nearly direct line, the distance being 140 miles.

South Florida.—It is reported that a branch is to be built to Lake Weir.

Statesville Air Line.—Surveys have been completed from Spartanburg, S. C., to Danville, Va., about 200 miles.

Toledo, St. Louis & Kansas City.—The work of widening the road to standard gauge is being vigorously pushed, and it is expected to have the work completed to East St. Louis by Oct. 20. During the progress of changing the gauge through freight has been hauled over the St. Louis, Vandalia & Terre Haute between Frankfort, Ind., and East St. Louis, but hereafter it will go over the Toledo, St. Louis & Kansas City from Toledo to Charleston, Ill., 319 miles, thence over the Bee Line, to be delivered in the yards of the former road at East St. Louis, thus giving the road an additional haul of 113 miles over its own tracks.

Union City, Louisville & Memphis.—A company by this name has applied for a charter in Tennessee to build a road from Union City to Reeves, and thence to Harris. W. R. Gardner and W. H. Griffin, of Union City, are projectors.

Wyoming & Eastern.—It is reported that a force of men and teams is at work grading on this road along the Sweetwater River, in Wyoming, and another near Ogden, Utah.

TRAFFIC AND EARNINGS.

Traffic Notes.

The Central Traffic Association and the Trunk lines refuse to put into effect the low rates to the Pacific Coast recently announced by the Southern Pacific.

The new Illinois distance tariff, recently adopted, has not yet gone into effect, delays having been occasioned by lack of time to prepare the necessary schedules.

It is said that the reduction in rates on cattle from Indian Territory and Southern Kansas points to Chicago is as high as 66 per cent. in some cases. There are said to be 150,000 head of cattle in that region ready to come East, and the rate war, if not soon settled, will involve large losses.

In adjusting the tariffs to comply with the recent decisions of the Inter-state Commerce Commission, the roads carrying oil from the western Pennsylvania regions have made material advances in the rates. The old rate per barrel (of 400 lbs.), Cleveland to New York, was 60 cents, but the new tariff, which is by the 100 lbs., whether in barrels or in tanks, makes the rate between these points 19 cents per 100 lbs.

During the next six months $100,000,000 in silver dollars is to be shipped from the various mints to Washington to be stored in the new treasury vaults. This, says the Boston *Herald*, ought to have an appreciable effect on railroad earnings. Wall street dealers in railroad securities should take notice.

Texas capitalists have established yards in Southern California for the sale of lumber from the heavy forests of yellow pine in Louisiana and Texas. It is said that arrangements have been made with the Southern Pacific for freight rates whereby prices of building lumber on the Pacific Coast will be reduced 35 per cent. or more.

Iowa Rates.

Forty-four merchants of Davenport have commenced suit before the State Railroad Commissioners against the Chicago, Rock Island & Pacific and the Chicago, Milwaukee & St. Paul, under section 18 of the state railroad law, claiming that freight rates are too high, that complainants are discriminated against, and demanding that the Commission shall prescribe more reasonable tariffs.

In the suits of certain Iowa roads against the Railroad Commissioners, concerning the tariff issued by the Board, which have been decided in favor of the roads, and have been appealed by the Commissioners to the Supreme Court, the

Chicago, Rock Island & Pacific has filed a supplemental petition, asking that Attorney-General Baker and Lawyer Bishop be enjoined from further prosecution.

Iowa Cattle Rates.

The General Freight Agent of the Burlington, Cedar Rapids & Northern has informed Chairman Fnithorn that he does not think in the face of the new Iowa law and the present complicated condition of rates in that state that he should take stock shipments from points outside the state at 25 per cent. lower than within the state. He says such a position could not be successfully defended either before the public or in the courts. He therefore will not join in the action of the other Iowa roads, and will make a 25 per cent. reduction on all cattle shipments to and from points on the lines of his road. Notice has also been given by the Chicago, Rock Island & Pacific that, taking effect Sept. 1, it will make rates on feeding cattle from points in Iowa on the Chicago, Rock Island & Pacific, Burlington, Cedar Rapids & Northern, and Minneapolis & St. Louis to Peoria to 75 per cent. of the regular established rates on stock cattle.

Musical Live Stock.

A Queen & Crescent route passenger train recently took out of New Orleans in the United States Express Co.'s car, a number of shipments of birds for Northern cities, which included 2,100 mocking birds, 680 red birds, 165 parrots and 845 Louisiana pops. A modest New Orleans reporter (not one of the ordinary kind) was wholly unable to interview the messenger or the birds, the latter keeping up such a din that talking was out of the question.

Grain Rates to Interior Points.

The Central Traffic Association has formulated the following resolutions concerning rates to interior points (west of Buffalo and Pittsburgh), which have been the subject of considerable strife lately. The resolutions have yet to be submitted to the General Managers for ratification;

Resolved, That, taking effect Sept. 15, milling in transit rates shall be established on a basis of not less than 1½c. per 100 lbs. above the rates from Chicago to New York, and that all roads parties hereto agree that on and after Sept. 15 they will not make grain rates at variance with agreed tariff taking effect Sept. 15, except for milling in transit purposes, as provided above; that this will only apply to such milling in transit rates to points strictly on their own route, it being understood in this case that the Chicago & Atlantic and New York, Pennsylvania & Ohio system shall be considered one road.

Resolved, That taking effect Sept. 15 we restore rates on grain from Chicago to all points as per joint rate sheet in effect May 14 and supplemented June 2.

Resolved, That taking effect Sept. 15 rates on scrap iron shall be restored to the basis of $2.50 per gross ton to Pittsburgh, $2.25 to Mahoning Valley points, $2 to Cleveland and Columbus, and to other points on the same basis.

The Kentucky & Indiana Bridge Co. vs. the Louisville & Nashville.

The Commission has put on file the opinion of Chairman Cooley in the case of the Kentucky & Indiana Bridge Co. against the Louisville & Nashville Railroad Co. The fact that the Commission had decided this case in favor of the plaintiff was announced in the *Railroad Gazette*, Aug. 10. Some further particulars are here given from the printed report and decision just received.

The railroad had a contract with the Louisville Bridge Co., whereby all its business was to be taken over the bridge of that company, and in which contract several other railroads united. The Kentucky & Indiana is a new bridge, and since its construction some of the railroads that had before agreed to bring all their business over the old bridge now propose to take it over the new. Among these is the Ohio & Mississippi Railroad Co. The Louisville & Nashville refused to receive freights that were brought over the new bridge for transportation to the south on its line, claiming that to compel it to receive them would be to impair the obligation of its contract with the old bridge company. This suit was instituted for the purpose of compelling the reception of such freights.

The Commission holds that as the bridge company has the right under its charter to lay tracks and operate a railroad, and as it actually owns tracks and rolling stock and works them it is a common carrier doing an inter-state business. There is therefore no alternative. Under the Inter-state Commerce law, which requires every railroad to afford equal facilities to every other in the transportation of freights, the Louisville & Nashville could not lawfully refuse to receive the freights because of their having been brought over the new bridge, but they must receive them and give the same equal facilities for their transportation, regardless of that circumstance. Order was issued to that effect. Commissioner Schoonmaker filed a separate opinion.

Western States Passenger Association.

A Chicago dispatch of Sept. 5 says: The reorganization of the Western States Passenger Association was completed today. The differences between the Chicago & Alton and the Wabash having been satisfactorily adjusted, the new agreement was unanimously adopted. It is to go into effect Sept. 15, and to remain in effect until dissolved by a majority vote of the Executive Committee. The southwestern lines, including the Wabash, adopted a supplementary agreement, and organized under the name of the Southwestern Passenger Association. It is to be governed by the rules of the Western States Passenger Association, where they do not conflict with the Central Traffic Association, of which the Wabash is a member.

Whether this organization will hold together until this paper reaches our readers we will not say.

East-bound Freight Shipments.

The shipments of east-bound freight from Chicago by all lines, for the week ending Saturday, Sept. 1, amounted to 43,825 tons, against 49,953 tons during the preceding week, a decrease of 6,128 tons. This includes flour, grain, seeds, provisions, dressed beef, hides, wool and lumber. The proportions were as follows:

	Per cent.
Wabash	9.7
Michigan Central	10.5
Lake Shore & M. S	16.3
Pitts., Ft. Wayne & Chic	13.9
Chicago, St. L. & P	12 1
Baltimore & Ohio	5.9
Chicago & Grand Trunk	12.1
N. Y., C. & St. L	9.4
Chicago & Atlantic	10 1
Total	100.0

Of the above shipments 3,617 tons were flour, 11,571 tons grain, 4,151 tons cured meats, 2,381 tons lard, 7,599 tons dressed meats, 1,324 tons butter, 1,688 tons hides, 672 tons wool and 2,949 tons lumber.

The shipments by the Vanderbilt lines amounted to 36.2 per cent., and by the Pennsylvania lines 26 per cent,

Cotton.

The cotton movement for the week ending Aug. 31 is reported as follows, in bales:

	1888.	1887.	Inc. or Dec.	P. c.
Interior markets:				
Receipts	13,092	25,637	D. 12 545	49.0
Shipments	13,928	25,100	D. 11,172	44.5
Stock	15.155	23,793	D. 8,638	36.2
Seaports:				
Receipts	23,639	39,309	I. 15,670	39.8
Exports	32,235	....	....	....
Stock	181,434	86,395	I. 95,039	109.9

Coal.

The coal tonnages for the week ending Sept. 1 are reported as follows:

	1888.	1887.	Increase.	P. c.
Anthracite	844,865	596.369	248,296	41.6
Bituminous	308,860	264,637	44,223	16.7

Railroad Earnings.

Earnings of railroad lines for various periods are reported as follows:

Month of July:

	1888.	1887.	Inc. or Dec.	P.c.
Allegheny Valley	$172,902	$165,436 I.	$7 466	4.5
Net	64.699	59,081 I.	5,618	9.5
Balt. & Potomac.	127,153	117,254 I.	9,899	8.4
Net	42,077	46 043 D.	3,966	8.6
California South.	115,741	106,230 I.	9,511	8.9
Net	15.192	39,545 D.	24,353	61.6
Cam. & Atl. & Brs.	106,864	117,021 D.	10,157	8.6
Net	40.999	55,246 D.	14,247	25.8
Canadian Pac	1,188,355	1,057,299 I.	131.056	12.3
Net	401,028	391,187 I.	9,841	2.5
Cen. of Georgia.	499 003	420,487 I.	78,516	18.4
Net	144,277	67,310 I.	76,967	114.3
Central of N. J.	1,256,251	1,049,411 I.	206,840	19.6
Net	612,728	508,998 I.	103,730	20.3
Cl., C., C. & I.	575,300	660,748 D.	85,448	12.9
Net	121,999	218,680 D.	96,681	44.2
Den. & R. G. W.	110,770	105,379 I.	5,391	5.1
Net	19,802	35,999 D.	16,197	44.9
Det., B. C. & Al.	49,605	51,350 D.	1,745	3.3
Net	17,066	24,366 D.	7,300	29.9
Ft. W. & Den. C.	89,869	68,387 I.	21.482	32 8
Net	35,948	34 880 I.	1,068	3.0
Louisv. & Nashv.	1,333,432	1,326,663 I.	6.769	0.4
Net	853.833	784,357 I.	69.476	8 8
Mar., Col. & Nor.	7,921	7,216 I.	705	9.8
Net	3,645	3,342 I.	303	9.1
Mem. & Char.	115,136	127,897 D.	12,761	9.9
Net	14,316	54,973 D.	40,657	73.9
N. Y., O. & West.	174.058	155,399 I.	18,659	12.0
Net	45.531	41,315 I.	4,216	10.2
Norfolk & West.	407,286	334,764 I.	72 522	21.3
Net	155,905	224,697 I.	31,208	25.0
Northern Central.	562,345	536,336 I.	26.009	4.8
Net	216,849	189,381 I.	27,468	14 5
Pennsylvania	4,822,412	4.654,370 I.	168,042	3 6
Net	1,598.410	1,674,541 D.	75,131	4.4
Phila. & Erie	440,468	386,976 I.	53,492	13 8
Net	195,748	177,122 I.	18,626	10.5
Phila. & Read	1,930,030	1,824,657 I.	105,373	5.7
Net	973.621	935.483 I.	38,138	4.0
P. & R. C. & I.	2,303 752	1.778,439 I.	525,313	28.9
Net	107.272	137,767 D.	29.495	21.3
Total both co.'s	4,233,782	3,603,096 I.	630,686	17.5
Net	1,080,893	1,073,250 I.	7,643	0.7
Southern Pac. Co:				
Gal., H. & S. A.	266,322	251.414 I.	14,908	5.8
Net	29,474	7.728 I.	21,746	282.4
Louis West	71,125	70,540 I.	585	0.8
Net	29,573	34,190 D.	4,617	10.5
Mor. L. & Texas.	335 526	297,388 I.	28,138	12.8
Net	71,799	64,887 I.	6,912	10.6
N. Y., Tex. & M.	9,793	9,547 I.	246	2 5
Net	def. 5,247	87 D.	5,334	....
Texas & N. O	109,424	107,750 I.	1,674	1.5
Net	22 543	55,499 D.	32,956	59.3
Total A. L. Sys.	792,199	736,839 I.	55.560	7.5
Net	148,142	162,301 D.	14,249	8.7
Union Pacific	2,544,063	2,479,372 I.	64,691	2.6
Net	1,029,995	1,167,670 D.	137,675	13.2
W. N. Y. & Pa.	289,757	251,552 I.	38,205	15.1
Net	93,496	77,620 I.	15,866	20.4
West J. and Brs.	191,201	199,974 D.	8,773	4.3
Net	78,244	92,319 D.	14,075	15.2
Wisconsin Cent.	316,221	334,317 D.	18,096	5.1
Total (gross)	$20,522,114	$19,053,693 I.	$1,468,521	7.7
Total (net)	7,030,922	7,103,322 D.	72,401	1.0

Seven months—Jan. 1 to July 31:

Allegheny Valley	1,141,951	1,109 867 I.	32,084	2 8
Net	447,985	399,405 I.	48,580	12.1
Balt & Potomac.	872,584	818,645 I.	53 939	6.5
Net	268,196	282,690 D.	14 494	5.0
California South.	1,022,601	839,771 I.	182,830	21.6
Net	254,118	376,372 D.	122,254	32.4
Cam. & Atl. & Brs.	359,874	360,289 D.	415	0.1
Net	43,928	61 506 D.	17,578	28.5
Can. Pac	7,021,745	5,786,092 I.	1,235,653	21.3
Net	1.514,898	1,332,524 I.	182,374	13.6
Cen. of Georgia.	3,719,938	3,131,077 I.	588,861	18.9
Net	1.075,614	796 761 I.	278,853	34 9
Central of N. J.	7,012,298	6,330,891 I.	681.407	10.7
Net	3,053 488	2,806 959 I.	246,529	8.7
Cl., C., C. & I.	4,076,010	4,191.616 D.	115.606	2.7
Net	988,911	1,282,655 D.	293,744	22 9
Den. & R. G. W.	711 207	582,583 I.	128.624	22.0
Net	151,531	140,537 I.	10,994	7.7
Det., B. C. & Al.	283,056	270,059 I.	13,007	4 8
Net	111 550	129,450 D.	17,900	13 8
F. W. & D. C.	530,255	358,617 I.	171,638	47.6
Net	193 067	140 858 I.	52,149	37.0
Mar., Col. & Nor.	48,012	35,212 I.	12,800	33.5
Net	19,972	15,110 I.	4,862	31.5
Memphis & Chas.	891,460	885,039 I.	6,421	0.6
Net	170.231	153.803 I.	16,428	10.6
N. Y., L. E. & W.	15,225,380	14,828,867 I.	396,513	2.6
Net	5,276,893	5,134,562 I.	142,331	2.7
N. Y., Ont. & W.	931,526	818.542 I.	112,984	13.7
Net	107,992	107,914 I.	78	...
Norfolk & West.	2,731,261	2,214,548 I.	516,713	22.3
Net	1,058,001	854,377 I.	203,624	22.6
North. Central	3,462.488	3,617,929 D.	155.441	4.2
Net	1,115,869	1,444,217 D.	328.348	22.7
Pensylvania	32,680,610	31,025.094 I.	1,655,516	5.3
Net	10,291,168	10,457,924 D.	166.756	1.5
Phila. & Erie	2,338,642	2,251 377 I.	87,265	3.8
Net	932,943	943,233 D.	10.290	1.0
Phil. & Reading.	11.087,624	11,979.155 I.	891,531	7.4
Net	4,836 912	6,122,463 D.	1:85,555	20.9
P. & R. C. & I.	8,962,961	9,424,485 D.	461,524	4.8
Net	109,472	422,909 D.	313.437	74.1
Total both co's.	20,050,585	21,403,649 D.	1,353,054	6.3
Net	4,946,384	6,545,370 D.	1,598,986	24.2
Southern Pac. Co.				
Gal., H. & S. A.	2,120,893	1,810,397 I.	310,496	17.2
Net	471,831	298 368 I.	253,463	12.1
Louisiana West.	516,421	452,416 I.	64,005	10.4
Net	237,709	203,000 I.	34,709	17.0
Morgan's L. & T.	2,774,058	2,240,407 I.	533,651	23.8
Net	789 197	366,180 I.	423,017	115.5
N. Y., Tex. & M.	62.448	92.063 D.	29,615	32.1
Net	def 37,746	2,449 D.	40,195	....
Tex. & New Orl.	773,672	686,875 I.	86 797	12.6
Net	187,361	305,078 D.	117,717	38 5
Total At. Sys.	6,246,468	5,281,156 I.	975,312	18.2
Net	1,648,352	1,085,076 I.	563,276	51.9
W. N. Y. & Pa.	1,688,119	1,487 094 I.	201,025	13.5
Net	454,777	234,561 I.	220,216	93.8
West J. & Brs.	857,173	800,484 I.	56.689	7.8
Net	314,175	294,586 I.	19,642	6.6
Wisconsin Cent.	1,684,302	1,645 291 I.	39.011	2 3
Total (gross)	115,587,555	110,073,659 I.	$5,513,876	5.0
Total (net)	34,439,983	35,020,397 D.	580,414	1.6

Month of August:

St. L. & San F.	515,200	577,400 D.	62,200	10.7
Den. & R. Gr	706.000	709,300 D.	3,300	0.4
Col., H. V. & T.	296,000	240,000 I.	56 000	23 3
Mil. & North.	90,450	81,810 I.	8 640	10.5
Long Island	451,773	428,891 I.	22,482	5.2
Mil., L. S. & W.	308,521	356,627 D.	48,106	13.4
St. Paul	2,078,000	2 007,896 I.	70,104	3.4
Norfolk & West.	416,495	351 000 I.	65,495	18 4
Tol., A. A. & N. M.	64,165	48,915 I.	15,240	31.1
Buff., R. & Pitts.	158,842	193,846 D.	35,004	18.0
Cairo, V. & C.	75,745	78,322 D.	2,577	3 1
Total	$5,161,191	$5,074,017 I.	$87,174	1.7

Early reports of monthly earnings are usually estimated in part, and are subject to correction by later statements.

The statement of the Cleveland, Columbus, Cincinnati & Indianapolis, including the I. & St. L. for July, and for the year up to July 31, were as follows:

Month of July:

	1888.	1887.
Gross earnings	$575.300	$680.748
Oper. expenses	453 301	442,068
Net earnings	$121.999	$218,680
Interest, taxes, etc	157,654	170 340
Balance	def. $35 655	$48,340
Additions to property	22,320	7,496
Balance	def. $57,975	$408,244

Jan. 1 to July 31:

Gross earnings	$4.076,010	$4,191,616
Oper. expenses	3,087.099	2,908,931
Net earnings	$988,911	$1,282.655
Interest, taxes, etc	1.167,084	1.201,793
Balance	def. $118,173	$80.862
Additions to property	143.735	416.7.7
Balance	$261,908	def. $335,867

The statement of the Californian Southern for July and the first seven months of the year is given below:

Month of July:

	1888.	1887.	Inc. or Dec.
Gross earnings	$115,741	$106,230 I.	$9,511
Oper. expenses	100,549	66,685 I.	33.864
Net earnings	$15,192	$39,545 D.	$24,353

Jan. 1 to July 31:

Gross earnings	$1,022 602	$839.772 I.	$182 830
Oper. expenses	768,482	463,400 I.	305,083
Net earnings	$254,119	$376,372 D.	$122,253

The earnings of the Central of New Jersey for July and the seven months to July 31 are as follows:

Month of July:

	1888.	1887.	Increase.
Gross earnings	$1,256,251	$1,049,411	$206,840
Oper. expenses	643,523	540,413	103,110
Net earnings	$612,728	$508,998	$103,730

Jan. 1 to July 31:

Gross earnings	$7,012,298	$6,330,891	$681,407
Oper. expenses	3,958,810	3,523,932	434,878
Net earnings	$3,053,488	$2,806,959	$246,529

Following is the statement of the Cairo, Vincennes & Chicago:

Month of July:

	1888.	1887.	Inc. or Dec.
Gross earnings	$62,569	$65,345	D. $2,776
Oper. expenses and taxes	40,070	36,552	I. 3,519
Net earnings	$22,499	$28,793	D. $6,295

The statement of the earnings of the Canadian Pacific shows:

	July, 1888.	Jan. 1 to July 31, 1888.
Gross earnings	$1,188,355	$7.021,746
Expenses	787,327	5,506,847
Net earnings	$401,028	$1,514,899

In July, 1887, the net earnings were $391,187; seven months in 1887, $1,332,524; increase in net earnings for July, $9,842; for seven months, $182,375.

The statement of earnings and expenses of the Norfolk & Western for July, and the seven months to July 31, was as follows:

Month of July:

	1888.	1887.	Inc.	P.c.
Passenger, mail and exp.	$100,951	$81.773	$19,178	23
Freight	306,334	252,561	53,343	21
Gross earnings	$407,286	$334,764	$72,522	22
Expenses and taxes	251,380	210,067	41,313	20
Net earnings	$155,906	$124,697	$31,208	25
P. c. of expenses to earnings	62	63		

Seven months—Jan. 1 to July 31:

Passenger, mail and exp.	$541,132	$407,196	$133,935	33
Freight	2,190,129	1,807,351	382,778	21
Gross earnings	$2,731,261	2,214,547	$5,6 713	23
Expenses and taxes	1,673,260	1,360,171	313,089	23
Net earnings	$1,058,001	$854,376	$203,624	24
P. c. of expen to earnings	61	61		

ANNUAL REPORTS.

The following is an index to the annual reports of railroad companies which have been reviewed in previous numbers of the current volume of the *Railroad Gazette:*